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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

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EDITORIAL NOTES—GAS, &c.

Imperial Continental Gas Asssociation.

THE several topics which the Chairman of the Imperial Continental Gas Association (Mr. J. Horsley Palmer) brought before the proprietors on Tuesday last were really more interesting than important, if we except the tokens that 11 per cent. increase in consumers and 10 per cent. increase in gas consumption offer of an exuberant prosperity. The Chairman could not on this occasion emphasize the continued success by quoting other figures, as the past half year has really nothing in common with the corresponding period of 1906, in view of the amputation of the French stations from the larger operations of the Association, and their formation into an independent homogeneous French Company, with statutes according to French law. In that French Company, the Association are the sole shareholders; so that the severance is not such a complete one as the absence of comparative figures would permit one to think who was not acquainted with the true inwardness of the matter. The change that has been made in this respect, while making no difference to the proprietors of the Association, was a very politic one for several reasons, which were explained some six months ago.

The review that Mr. Palmer made of the past half-year's operations brought out experiences somewhat kindred, with certain variations, to those which were being related at the meetings of home-operating companies but a few weeks since. Take coal as the principal example. The Association have in the half year been paying the highest price that it has been their lot to pay since 1900-1. It was 19s. 3d. per ton, as compared with 20s. 11d. seven years or so ago. But the increased value of coke, and the reduced costs of handling, through mechanical coke and coal arrangements, have brought down the net cost of coal to near the average of the past five or six years—that is to say, to 7s. 5d. The Association will not, we fear, at the close of the current half year be able to report such a net cost, as, for their stations in North Germany, they have to store well in advance of the freezing of the Baltic and of possible inclement weather; and, consequently, this half year dear coal is being carbonized, while coke has receded from its recent best prices. But these things have a way of adjusting themselves, and this time next year we shall probably be having the Chairman reminding that the stored coal was bought at 2s. per ton less than under the 1907 contracts, and that coke stands at a respectable price. A point of interest in this connection is that the expanding business of the Association has caused the quantity of coal carbonized to pass in the aggregate 1 million tons per annum. The Chairman had some few censorial remarks to make—and they were not too severe—on the autocratic methods of the Westphalian Coal Syndicate, which cause on the part of users complaint of quality, delivery, and price. Redress appears to be beyond question. One well might wish the Syndicate would mend their ways, for then it might be that there would be a further averting of the eyes of responsible gas engineers on the Continent from British coals.

The question of vertical retorts was not brought prominently before the meeting. But it was stated in the report that the eight settings of vertical retorts at the Mariendorf works mentioned in the previous report had been completed. Seven of these settings, it will be recollected, contain twelve retorts each, and the eighth setting was intended to contain five retorts, each retort being of nearly treble the capacity of those in the other settings. Now it is further announced in the report that the construction of an additional thirteen settings has been put in hand. Mariendorf, it will be seen, is going in for this form of working on the large scale; but it is a singular observation that—with the exception of the Bockenheim works at Frankfort—at no other station of the Association is anything but the older systems of carbonization (horizontal, with machine work, or inclined retorts) being constructed. What is more, the engineers at the other stations have not yet told us much as to what they think of the vertical system. It must have been an oversight on the part of the Directors not to have mentioned in the report what is being prominently announced—viz., that 120 vertical retorts are now under construction, or have been arranged for, at the Frankfort (Bockenheim) Gas-Works. Among other matters, it is worthy of note that prepayment meter robberies are fewer in Germany than in this country. Whether this is due to a higher standard of morality or to the more frequent collection of cash from the money-boxes of the meters, as instanced by the fact that, from 367 meters broken open in Berlin last year, only 75s. was stolen, we, of course, cannot say. But there is the fact; and it is an interesting one.

Engineering and Travel.

UNDER the title of "Round the World—and Some Gas-Works," the first of a series of articles, from the pen of Mr. Maurice Graham, appears in another part of our present issue. It will be remembered that some little time ago, Mr. Graham, on relinquishing control of the engineering establishment so widely associated with his name, mapped out a world-wide twelve months' tour; and it is but natural that his technical and gas engineering experience should induce him to take interest in and visit various gas-works in the many countries through which his travels will lead him. His impressions, descriptions, photographs, and notes (often unavoidably written hurriedly and inconveniently in trains), undoubtedly show that energy and activity, brightness and adaptability, which have been characteristic of him in all his undertakings.

His first article relates to Egypt, and though gas affairs do not occupy a very important position in the industrial concerns of that ancient country, yet there are matters not devoid of interest to the gas and water engineer. Perhaps no other country in the world so brings home to the mind of the modern traveller both the distance and proximity of the old and new civilizations. An electric tram ride will carry one from up-to-date Cairo to the middle ages, and beyond to the first and desert dawn of civilization. One can see some of the marvels of building construction dating back for thousands of years, and wonder at the labour and resource that accomplished such achievements with so few mechanical advantages. In the fourteenth century B.C., the Egyptians probably knew of the wedge, the lever, and the inclined plane, but not the screw, the pulley, or wheel and axle—nor the inclined retort, though Mr. Graham refers to a pictorial representation of something that resembles a gas-cooker, which probably is an altar and offering of food and fruit to propitiate and support the dead. But in two of his other interesting photographs can be seen an early and elementary application of the principle of the lever to raise water from the river; and also of crude toothed gearing for driving elevator water pots. Such instances as these bring home to the mind the antiquity and the modernity of engineering.

Another thought that arises is the intimate relationship of engineering and travel. Without the former, there could not be the latter. Who, when and where, cut and made the first path and the first road? Who first hewed a boat or timbered a raft for navigation? Who threw the first bridge? Who was the originator of travel? These are, of course, vague questions. But they serve to take the mind back to distant times, and to realize, in part, the fundamental interdependence of engineering and any form of locomotion, whether in the earliest epoch of time or the twentieth century.

This certainly may be said: That in quite recent times increasing facilities and ever-growing demands have made everyone a traveller. And its effect has been, and will continue to be, entirely beneficial. It has more or less of the same effect as that of International Exhibitions, which, in a

way, are themselves collections or groups of travel. They are concentrated travel, so to speak. If we cannot go to the countries, the countries can come to us. They widen the outlook and deepen knowledge, whether generally or more strictly limited to gas matters. The wider the travel, the sounder the view, the greater the sympathy. So that recent years have certainly witnessed, on the part of the gas profession (to restrict ourselves to our own particular field of labours), a disposition to know and to understand the gas doings of others, and to stimulate by personal visits, wherever possible, the intercourse between gas engineers of different countries. All of us cannot go far, if at all, abroad. But we can all keep in touch with foreign affairs—gas and other; and by the medium of the Press we can be brought into realizing the conditions and environment of our fellow-men. It is because we believe that the greater the knowledge a gas engineer at home has of the difficulties of the gas engineer abroad, the sounder will be his judgment, and the better will be his services to his undertaking, that we are pleased to publish from time to time records of foreign gas-works. Further, if they serve only to show to the gas worker in distant parts, under trying climates and onerous conditions, something of the sympathetic remembrance of those staying at home, such articles as those of Mr. Graham's and others are not without their far-reaching effect and utility.

Illumination and the Municipal Councillor.

The campaign that Mr. Leon Gaster started a few years ago to reduce, or rather raise, illumination to a state dominated by definite laws has not, with time and a discouraging indifference by others, lost anything in the way of enthusiasm on the part of the originator. This was made abundantly clear by the lecture, which was intended for the ears of municipal authorities, delivered by him last Wednesday at the Municipal Exhibition at the Royal Agricultural Hall. We are, however, afraid Mr. Gaster has projected himself much in advance of his times, and that he lives in spirit, if not in fact, in a world in which illumination is not affected by commercial competition, and where, as the hymn of our childhood puts it, "all is peace and joy." The lecture was entitled "Efficient Illumination and Municipal Require-"ments." But the lecturer did not give any guiding indication as to his definition of "efficient illumination," nor did he, in the forcible manner we should like to have heard, point out the propinquity of reasonable economy to efficiency. This, however, we may say, that the whole intention of the lecturer was to show municipal authorities how to get the best value for money in illumination. Municipal authorities are responsible for a great deal of artificial lighting—the lighting of schools, of public buildings, and of the streets. But there are few among the thousands of municipal councillors in this country who understand anything of the principles of illumination; and personal and municipal interests and official influences play a greater part now, and ever will do, than any scientific principles in determining the form of illumination to be applied in any place. These walls of Jericho, neither Mr. Gaster nor any Illuminating Engineering Society, nor any central testing-station financed by municipalities, will succeed in razing to the ground, so that science, efficiency, and economy can march in triumphant.

Mr. Gaster's advice to municipalities is to away with disorder, incongruity, inefficiency, and wastefulness in their public lighting arrangements by the institution of a central testing-station for all new lamps and contrivances; the station to be under the charge of a committee, and with a man in occupation whose disinterestedness would be above suspicion, and who should, through the committee, make periodical reports, in a manner that should be of guiding service to the subscribing municipalities on all matters appertaining to illumination. However helpful all this might be to the securing of greater perfection and better administration, we fear that it is but a vision that will never materialize. The permanent officials of municipalities are antagonistic to any single part of their duties being centralized, or transferred, outside their own office; and they like the glory and the opportunity, and the hoped-for, though not always realized, reward, that their own individual trials, investigations, and exertions open to them. Further, cut-and-dried standards of illumination and the specification of lamps, however expert the authority standardizing and specifying, would not be generally acceptable by municipal councillors. People have different ideas as to what constitutes efficient illumination, and decline to have leading-strings attached to them in the matter, or have their line of action in any way defined. Stubbornness is not by any means a minor quantity in the characteristics of a certain type of councillor to be found on almost every local governing body in the country. Another important factor that operates against Mr. Gaster's proposal is that many municipal authorities are owners of electricity undertakings and not of gas undertakings; and a majority of members on these authorities have an understandable inclination to gently but firmly put economy and efficiency on one side, and patronize the electricity undertaking. There is another common reason why rational illumination could not be very effectually assisted by a central testing-station, except to show the efficiency of lamps under well-defined and protected conditions; and it is that there are in the country no two situations precisely alike that have to be illuminated by the public authorities, and practically every situation requires special treatment.

While these considerations are advanced in connection with this fresh proposal, we are among the first to admit that there is plenty of room for greater knowledge among the members of local authorities concerning the proper principles of illumination, and plenty of room for better and more intelligent treatment of streets and public buildings in this respect. Had greater intelligence animated conduct in regard to public lighting in the past, there would not have been the appalling waste in this direction that has helped very materially to burden, and uselessly to burden, the ratepayer. Except, however, from the position of gas undertakings as ratepayers, we are not at all sure that the prodigality, the inefficiency, and the failures in public lighting of electricity have not been an advertisement excellent in design, and very favourable in effect, for the gas industry. While making these admissions, we do not care to plead blindness to the obvious obstacles and objections that will make Mr. Gaster's new proposal appear to those who he suggests shall subscribe the funds as something eminently suitable for the shelf.

Tests of High-Efficiency Gas-Lamps.

Good work has been done by Mr. W. R. Herring in preparing the comprehensive account which we have the pleasure of publishing of the gas-lighting arrangements at the Scottish National Exhibition, in which account are also comprised exhaustive tests of the lamps there installed, together with some "wrinkles" from this free critic by which lamp makers and lighting engineers may profit. In the exhibition, gas is accorded, both outdoors and indoors, a very substantial part of the lighting; and thanks for this are due to those who exerted themselves on behalf of gas just at the critical time when it looked as though it would have a poor part allocated to it in the lighting. The value of the results of the tests included in the article is found chiefly in the fact that they are entirely independent of the manufacturers of the lamps, and that they have been made without favour of any kind. In fact, as an examiner of lamps, Mr. Herring unblushingly acknowledges himself nothing short of a martinet. Every lamp tested had to stand on its own merits, without any reflecting aid from surrounding objects; and the tests were made by a Simmance-Abady portable photometer, which was scrupulously verified. The gas used in the tests was of 20 to 21 candle power, rated by the "Metropolitan" No. 2 burner. To this gas of higher illuminating power than is ordinarily supplied this side of the Border, some little difference must, of course, be credited in respect of the illuminating efficiency per cubic foot; but, as we showed last week, the higher efficiency, using incandescent burners, is not by any means proportionate to the difference in the illuminating power of the gas.

The tests bring forcibly before us the remarkable progress that has been made in efficiency in inverted incandescent lamps. The improvement has been so persistently steady (not with that startling stride in high-pressure lighting announced last week) that we have almost unconsciously allowed the progress to be made without due observation, until it has been brought to view in some striking manner. When we find, under the rigorous conditions of testing that were adopted in Edinburgh, inverted lamps specially constructed with a view to get the most out of the gas, at ordinary pressures, giving such efficiencies per cubic foot as 37·4, 40·7, 41·1, and 45·8 candles with clear glass globes, and 35·2 candles with frosted globes, the effect of improvement needs no further emphasizing. But we do not want to take credit for high

efficiency without precisely stating all the conditions under which it is realized; and the conditions Mr. Herring clearly defines. It will be seen, *inter alia*, that the best efficiencies are obtained with the different inverted lamps (with gas at the ordinary pressures) when tested at an angle of 45°; but a noticeable fact is that, with the Keith new high-pressure lamp (a special description of which appeared last week), and tests at angles of 2½°, 4°, 20°, and 37°, the differences in the remarkable efficiencies per cubic foot of gas at the various angles are so small as to be almost negligible. In describing the tests of this new high-pressure lamp—giving results of 64·9 to 73·6 candles per cubic foot of gas—there is brought before us the importance of having correctly shaped and sized mantles for the flames of every type of lamp, The tests included in the article for these lamps are those which Mr. Herring kindly furnished to supplement the article in last week's issue; and one interesting point that he now brings out is that, with a pennyworth of Edinburgh gas expended in an hour, a light of no less than 2230 candles is yielded.

High-pressure gas lighting, however, under present conditions, is not convenient or desirable in situations other than large interiors and for outdoor lighting; and, therefore, the big advance that has been made in other forms of lamps that are independent of external means of improving lighting capability, is a matter for much satisfaction. If the Edinburgh tests of such lamps are compared, the importance of various points in securing good and regular efficiencies are at once brought to notice. Consonant results between lamp and lamp of even the same make cannot be obtained without the means of securing perfection of regulation; and the preheating of the air supply cannot now be dismissed, as it has been in the past by some, as having no virtue in improving efficiency. Every lamp, too, shows that there is a point in consumption to pass which produces a loss in efficiency per cubic foot of gas consumed, no matter how carefully the air supply may be proportioned to give the maximum illumination at the higher consumption. The maximum efficiency per cubic foot is found at the lower end of the range of consumptions at which the tests were made by Mr. Herring. These are among the interesting lessons to be drawn from his instructive series of tests, which also show that there is now practically an unlimited choice of highly efficient lamps. All such lamps could not, of course, be comprehended in the Scottish National Exhibition.

Electric and Gas Lighting at the Welsh Meeting.

Lighting and carbonizing at the present time transcend in importance all other subjects in the eyes of the gas engineer and manager. For the enveloping of questions with special interest at a particular period, there is always some reason. In lighting and carbonizing, there are causes inciting present activity, and there are results that excite interest and impel forward. How much credit should be given to self-preservation for the reawakening in both directions, how much to external pressure, how much to a desire to do the best possible for every class of consumer, how much to the promptings of the technical man with head and heart in his work to realize the ultimate economy, or how much to enthusiasm, we cannot, and shall not waste time in attempting to, determine. Whatever the cause or causes, sufficient for us is the value of the effects. Lighting was the section of technical topic that gave the subjects for discussion at the meeting of the Welsh Gas Association last Wednesday, when the Cardiff Gas Company, through their chief officials, gave the members most cordial welcome and entertainment. The papers submitted were by Mr. J. H. Canning, dealing with the various new electric lamps, and by Mr. A. J. Ward treating of the high-pressure incandescent lighting at the Queen Alexandra Dock, Cardiff.

The discussion on Mr. Canning's paper was somewhat disappointing; and had it not been for the life infused into it by Mr. T. Canning, it would really have been of small account. The subject of the new metallic filament electric lamps—their prospects, their effects, their good points, and their weaknesses—is one which, in its every phase, should be studied by gas managers; for there is no doubt that the most effective way of dealing with a rival is to know all about him. An endeavour has been made through our "Electricity "Supply Memoranda" to keep readers *au courant* with all that is passing in connection with these lamps. In the discussion, great prominence was given to the progress which they represent in efficiency regarded only from the relationship of lighting to consumption. This advance—the considerable and significant nature of which we should be the last to deny—was heralded throughout the discussion; and, in an abstract sort of way, the effect upon the gas industry of the competition of these higher efficiency lamps was also treated upon. But as there will be interested electricians reading our report to ascertain what gas men think of the new "situation" in the electrical industry created by the latest forms of lamps, we would fain have seen something more introduced into the speeches respecting the advances made in incandescent gas lighting, which are equal to effectively combating the new lamps of the electrical industry. True, metallic filament lamps are making a brave show in shop window lighting; but, so far as an extensive observation goes, in many cities and in many towns, the metallic filaments are merely, in both suitable and unsuitable positions, displacing carbon filaments. We are not going to try to belittle the metallic filament lamps. We regard them as worthy opponents; but, all the same, we are not going to be guilty of any such misrepresentation as that the incandescent system of gas lighting has not made such progress in efficiency that its economy still stands far ahead of anything the electrical industry can yet put forward. However, the positive assurance of superiority must not lull one into any sense of security, as the new lamps have undoubtedly made electricity a more formidable business opponent.

Since Mr. Canning prepared and first published his paper, much has happened. This was only eight months ago; but the flight of events has been such that already the paper really requires supplementing and revising. Several of the defects of the metallic filament lamps have found remedy, simple transformers have been contrived for reducing high voltages to low, to do away with the necessity for running such lamps in series, and 32 and 50 candle power metallic filaments have been made which can be used singly, without the interposition of transformers, on voltages up to 240; and it is hoped to realize still lower illuminating units that will comport themselves with grace and dignity on the higher voltage systems, though it is questionable whether there will be success without sacrificing efficiency. This indicates rapid advance; and, having regard to this stronger position of the electrical industry in possessing these improved lamps, there comes the consideration of the question that Mr. T. Canning put as to how far they are going to be substituted for incandescent gas-lamps. The opinion may be expressed that we do not think their injury, commercially, to the gas industry is likely to be anything so great as their injury to the electricity industry itself. And why? Not the least important reason is that those who are engaged in the development of the electrical industry, with their experience of the difficulties of making headway among householders, do not think so; for they are now talking of making up the loss of revenue represented by the difference in consumption between these lamps and carbon filaments not by increased business, but by rearranging the basis of their charges for current! Another reason is that these lamps have not in any way reduced a single expense in connection with electric lighting other than for electricity, while they have increased the first cost of lamps and the cost of renewals. A still further reason is that the capital cost of services and meters is such, and the scale of revenue derivable from private consumers will, without the electricity supply undertakings consummate the contemplated revision of charges (which will maintain the old competing relations of the two industries), be so much lower, that revenue from many private residences will hardly equal capital and other standing charges, without taking into account generating and distributing costs. There has been great recklessness in the past among electricians in making bids for business; the metallic filament lamps are having a chastening and sobering influence.

The paper read by Mr. Ward on the high-pressure incandescent lighting of the magnificent Alexandra Dock does not give much scope for comment. It is a useful statement of facts regarding the successful and economical lighting by gas of this most important undertaking. Mr. Ward, as the Manager of the Cardiff Railway Company's Gas-Works, is not beset by competition, and he is not disturbed in the slightest by the strategic moves of a trading rival to score advantages. All he has to do is to achieve the best possible for his Company, and in the most economical way. Therefore, he suggested the lighting of the new dock by high-pressure gas-lamps; and he finds, as he expected to find, that these lamps—and they are not of the new and more economical type that have just put in an appearance—are "cheaper" than electricity, and "give equal, if not superior, results as

"regards light." Being their own gas manufacturers and customers, the Company are, as a matter of fact, lighting the dock at a cost of ½d. per 1000-candle power per hour. Our electrical friends, knowing nothing of the matter, are often using the licence of the ignorant by referring in exaggerated terms to the fearful cost of maintaining high-pressure gas mantles. Mr. Ward tells them, and all whom the matter may interest, that—gales, clouds of coal dust, and vibration notwithstanding—an average of two months' life is the portion of each mantle. If electricians will compare this with the carbon requirements of flame arc lamps, they will, on this subject, for ever hold their peace.

Revivifying the Spirits of Coalite Shareholders.

COALITE is not dead, nor is it sleeping. That is the conclusion Coalite Limited, the parent Syndicate (which gave birth to the British Coalite Company, Limited), desire should be drawn from a circular they have issued to the shareholders. We imagine this is either a sort of prelude to an appeal for more capital, or is intended to revive the drooping spirits of the shareholders. The British Coalite Company acquired the patent rights for the United Kingdom; and it will be remembered that the promoters of the Company, with constant and adroit preliminary angling, only hooked part of the money required, and there were ominous rumours that the underwriters—reputed to be the parent Syndicate—were not meeting their liabilities in the matter with the promptitude that was desired. But now the Directors of the Syndicate have "pleasure" in informing the shareholders that letters patent in respect of the process have been granted in 31 countries, colonies, and dependencies. Little good are these likely to do the Syndicate, after the miserable reception of the British Company and their proposals at home, and the equally miserable showing they have made with their operations up to the present.

But the British Company are stated to have erected new and larger works at Wednesfield, near Wolverhampton, for the manufacture of coalite and the bye-products, and have in course of construction extensive works near Barking, "to "meet the enormous and increasing demand for the fuel in "the Metropolitan area." With regard to the "new and "larger" works at Wednesfield, it would be interesting to learn something about their capacity; and as to the extensive works near Barking to meet the "enormous and in-"creasing demand" for the fuel in the Metropolitan area, we have failed to locate any such demand. It will be remembered that it is necessary, in order to make a financial success of the process, that the Company should find a profitable outlet for the gas they produce; and a Bill was promoted in Parliament this session, but was dropped almost as soon as promoted, for empowering them to distribute and dispose of the gas for power purposes. Various rumours were soon afloat as to the cause of the vagarious actions of the Directors in this respect; one of them being to the effect that the Company have entered into an arrangement for the supply of the gas for power purposes to one of the electric power companies with a scheme now before Parliament, and who are proposing to construct a generating station alongside the Coalite premises at Barking. "There's many a slip 'twixt 'cup and lip;" and the Bill is not through Parliament yet. Rumour, too, may prove a false jade again.

Another salve in the circular for the wounded shareholders are the leading points of the famous Cantor lecture recently delivered by Professor Vivian B. Lewes. The circular states that the Professor "is the recognized authority on the "matter," and that he demonstrated in his lecture, "in a "very striking manner, the advantages that would accrue, "both to the gas manufacturer and the public, by the uni-"versal adoption of the coalite process as against the ordi-"nary method for the manufacture of gas." Professor Lewes, in his lecture, only expressed his individual view, which view is opposed to the collective wisdom and experience of the practical and commercial gas experts throughout the United Kingdom. This fact does not appear in the circular, though the authors of it have certainly been made well aware of it from the criticisms of the lecture that have appeared in the "JOURNAL." However, the circular concludes with the statement that negotiations are actively proceeding with important financial groups in the principal countries in Europe and America for the sale of the foreign rights, and, "when completed, the results will be highly "profitable to the Syndicate."

Before the prospectus of the British Coalite Company was issued, the public through the daily press were surfeited with advertisement and puffing articles of various kinds, the main feature of which was the eye-deceiving substance of the fabric that was therein constructed from the thinnest of material. The best analogy to those articles is the fine and attractive exhibition building of modern times which is largely composed of a skeleton of wood, with an integument of plaster. It is to be hoped that the public are not going to have this kind of thing served up again to them; but our fears are aroused by a suspicious looking article in last Saturday's "Globe." If the writer of the article is independent of the Coalite Company, it is very curious that his interest has been aroused just at the present time; but whoever he may be, we can give him credit for a diligent study of the literature of the Coalite Company and of Professor Lewes's lecture. In addition—shareholders with drooping spirits, please note—he asserts that "nearly a year has "elapsed since coalite was first introduced to the British "public; and there is not one claim that was then made for "it that has not been fully substantiated." The worst form of gullibility is that which is chronic. We are also told that orders for hundreds of thousands of tons of coalite have had to be declined because the plant for its manufacture was not sufficient to meet the demand. But that is now being rectified; and then we shall see—well, what we shall see. The attitude of gas companies towards the system is looked upon by this writer with big amazement at their folly; but the gas industry happens to know something more of its own business than the Coalite Company or the writer in the "Globe." There is for us one bit of information in the article. It is that a "large" gas company, managed on "progressive" lines is having a coalite plant erected at their works for making 500,000 cubic feet of gas a day; and it is "confidently hoped "that the results will so far overcome the prejudice and "opposition of the gas companies, which at present stand in "the way of the public receiving the full benefit from the "low-temperature coalite process." We would suggest that interest in this matter should be aroused by the Coalite Company offering prizes for the correct naming of the "large" and "progressive" gas company. As to the confident hope regarding the results of the trial having a beneficial (for the Coalite people) effect in removing prejudice and opposition, we cannot see any ground for sharing in it.

Some Excellent Advice to Juniors.

After the first-rate quality of many of the papers that the members themselves have proved able to produce, one of the most gratifying features in connection with the various Junior Gas Associations is the active encouragement that has been extended by senior members of the profession to these organizations, which has doubtless had much to do with their success. Of course, had they not had the full acquiescence of their chiefs, the members of the Junior Associations would have found the idea to be an altogether unworkable one. Beyond, however, the adoption of a permissive attitude, the seniors have frequently, by attending and taking part in the meetings, actively assisted the proceedings of the Associations; and on a good many occasions, too, they have filled the principal part at such gatherings—namely, that of lecturer. The latest instance of the latter piece of good fortune falling to the lot of one of these bodies occurred last Friday evening, when, at the annual general meeting of the London and Southern District Junior Gas Association, Mr. J. W. Helps delivered an address to the members which contained plenty of food for reflection. What he had to say was, of course, greatly appreciated at the time by those who heard it; and it will be even more so—not only by the members of that particular Association, but by those of other similar organizations—when it is read in the present issue of the "JOURNAL." Though Mr. Helps called his address a "friendly chat on matters of every-day happening," it was in reality a good deal more than this; and he succeeded admirably in the intention with which he started—namely, that of drawing attention to the importance of applying to the daily routine such methods of systematic observation as will not only add materially to the interest taken in the work, but which will convert what may perhaps appear to possess but little importance in the furtherance of the interests of the industry into a work of distinct value—forming, as it will, a no inconsiderable link in the chain of knowledge which must be forged before anything approaching

real success can be obtained. Though not recommending any process or mental attitude which will result in a man so limiting his thoughts and vision as to exclude the consideration of the whole matter of which details form but a part, Mr. Helps strongly advocates such a system of training as will permit the worker to cultivate that power of concentration which will enable him at will to confine his attention to any particular difficulty or problem until he has thoroughly mastered it, in spite of the obstacles with which he will probably be confronted, and convince himself that he perfectly understands the reasons for the altered conditions and for the successful results he has finally obtained. Mr. Helps quoted examples to show the great opportunities that still exist in gas-works for such observation of every-day conditions as will lead to more intimate knowledge of the principles involved in the various processes, and the solving of many important problems; and though these related to retort-house practice, the training of the power of observation which he advocated applies, of course, to all branches of the industry—and, may it be added, to other businesses as well? Those who steadfastly follow the advice of Mr. Helps, will at some time or other feel grateful to him for having given it.

Electricity at the Franco-British Exhibition.

In close proximity to the exhibit of the Gas Section Committee of the Franco-British Exhibition, an electrical pavilion is, after all, to be erected. The idea was once abandoned through insufficient support; but the company electricity supply interests in London apparently could not stand the taunts of the electrical press over the want of enterprise that proposed to let electricity go unrepresented, nor did they like to hear of a subscription by gas-supply companies and committees of some £4000 to demonstrate there the uses of gas. The London Electricity Supply Companies have therefore guaranteed sufficient funds for taking space, and giving an order to Messrs. Waring for the erection of a handsome pavilion. The Companies are now again appealing to the electrical trade to co-operate. The idea is that the Companies shall provide the space and the pavilion, and that some thirty firms shall subscribe about £20 each to cover the expense of wiring, current, and attendance during the run of the exhibition. The pavilion will contain a suite of furnished rooms, and in other apartments will be seen small machinery operated by electric motors, medical apparatus, and general exhibits. There is also to be a reception room and information bureau. From the beginning of the organizing of the exhibition, there has been talk of "only a little space left." Of course that is an old exhibition promoting ruse. There seems to be no difficulty in getting space even within forty-eight hours of the opening day, when, as usual, there will be little in the way of exhibits to be seen. Only a fortnight ago, the Gas Section Committee were inviting manufacturing firms to take space; and now the Committee dealing with the electrical exhibit state that they have the option of extending the space they have taken, and there need be no fear of cramping. If therefore provincial electricity supply authorities will do their part in furnishing the funds for taking space, even now there will be no difficulty in getting additional manuturers to supply the goods for filling it, with a small subscription for incidental expenses. That is how the matter stands for an electrical display.

Ratepayers and Local Inquiries.

The welcome which a Local Government Board Inspector gave last week to a couple of ratepayers who offered a show of opposition at an inquiry which he was conducting in Devonshire, directs attention to the formality to which such proceedings are usually reduced. In theory, the object of these investigations is to enable the Department to ascertain all that is to be said for and against a particular scheme for which a local authority may be seeking to borrow money. In practice, the result, for the most part, is a mere oral repetition by official witnesses of information already furnished to the Department in writing. Few attend except the officials immediately concerned. The majority of the ratepayers probably do not know that an inquiry is being held, and the minority who do know do not care enough about the matter to be present. The fact is that unless the question under consideration has excited party feeling in the town, these local inquiries are farcical. In the main, this is the fault of the ratepayers. The average man is apt to be very indifferent to things which affect his interests, and even touch his pocket, if they do not appeal to his feelings. He will get greatly excited at parliamentary elections over the employment of yellow or black labour in the plantations of Timbuctoo or the sale of opium in Han-Kow; but he will not take the trouble to walk to the corner of the street to vote in a local election, though the government of his town or parish is a matter which affects his daily life, and determines the amount he has to pay in rates. It was not without reason that Mr. Asquith spoke in terms of praise last week of the patience of the democracy under taxation. A better word than "patience" would be "indifference," so far, at least, as a very large proportion of the ratepayers of most towns are concerned. One result of this want of interest in affairs by those who ought to control them, is that the management of municipal business falls into the hands of cliques and "rings," and we have such scandals as have recently been exposed at Poplar and West Ham. Another, and not less serious, result is that municipal authorities are enabled to pile up debt without limit, and to indulge in fantastic experiments in Socialism for which others have to pay. We believe it to be perfectly true that among those who complain most of this state of things are some who set the worst examples of indifference. The fact is that attention to the details of municipal administration makes large demands upon one's time and energy; and it is not every man who is prepared to make the necessary sacrifice. An active and vigorous Ratepayers' Association sometimes supplies the want of individual effort in examining and criticizing the proposals of local bodies, and is the means of preventing the execution of foolish and expensive schemes. But a Ratepayers' Association, if it is to be of any effective use, must have the support of the ratepayers, or it, too, will be dominated by cliques, and become ineffective in its criticism and useless as a representative of opinion. It is somewhat of a satire upon such of these Associations as exist that a Local Government Board Inspector should be in a position to complain that the inquiries he holds are for the most part poorly attended, and to welcome opposition as a relief from a state of things bordering on monotony.

Old-Age Pensions.

The budget which was introduced by the Prime Minister last Thursday—the final act in connection with his former office—has been received with mixed feelings. In it Mr. Asquith has maintained the policy of the Government in domestic matters, of looking only to the interests of one class, and ignoring and sacrificing the interests of all other classes. With trade tumbling from the height to which it reached in the last three years—imports and exports having already declined by several millions this year—he has launched his old-age pension scheme with an ease or indifference which is not altogether pleasant for those who have to subscribe the funds for these flights of the present administration. The scheme will not entirely please any section of the community. It will not please the labour party. In placing at 70 the age at which a person will be qualified for a pension, it goes at least five years beyond the age that the labour party desired. The pension (which is to commence on Jan. 1 next) is not to be universal or non-discriminatory, nor is provision made for the "physically unfit," as was required; but it is to be non-contributory. No one with an income exceeding 10s. a week is to be eligible for the 5s. a week pension; so that the universal and the non-discriminatory conditions of a satisfactory (to the labour party) old-age pension scheme have been knocked on the head. But the labour party are bid to be thankful; and to develop this means of ameliorating the lot of impecunious old age on the instalment principle. The scheme will not please the ratepayer. The burden in its early stages is estimated at £6,500,000 a year; and if, as Mr. Asquith says, there are at least 500,000 people, who are not in receipt of poor-law relief, are not lunatics, aliens, or criminals, who are above 70 years of age, and are entitled to this £13 a year, the £6,500,000 will not be sufficient to cover in addition to the pension the machinery that will have to be put into operation to carry out the scheme. If this is only to be taken as an instalment of a much larger policy, we can see in it the source of a prodigious burden for the already hard-pressed ratepayer. The Government could not have devised a more effective plan for blocking the way of such beneficent schemes as co-partnership between capital and labour; for with their existing burdens, increased in weight now and still more so prospectively, employers

will console their consciences with the plea that they are, through State agency, doing for their employees all they are called upon to do. Philanthropy has also received a hard and repulsing blow.

Inconsistencies.

In introducing the scheme, Mr. Asquith made this notable statement: "I would not buy even such a boon as this for the veterans of the country at the cost of Free Trade; and for the simple reason that, in my opinion, the most short-sighted of all policies is to imagine that you can permanently relieve the necessities of *one class while you are slowly but surely impoverishing the general resources of the people.*" What is the increasing burden of the rate and tax payer doing? The answer is: "Slowly but surely impoverishing the general resources of the people." What does the Coal Mines (Eight Hours) Bill threaten to do? The answer is much the same. The Prime Minister has provided words here which his policy will in future allow many opportunities for quoting against him.

More Capital for a Cannon Street Promotion.

The (New) Toddington and District Gaslight and Coke Company, Limited, are hard up for money. They ought not to be; but the fact remains. This is one of the Cannon Street promotions, and, needless to say, a scandalously over-capitalized concern. The Company are credited with a capital of £20,000, with a consumption of gas only a little over 2 million cubic feet per annum, with a price to the consumers somewhere about 5s. per 1000 cubic feet, and prepayment consumers charged round about 1s. in addition. With such a capital, with such a price, and with such a district, what prospect has this Company of ever pulling itself into a financially sound condition? It must be a big temptation now that will induce people to part with money to put into such an exorbitantly capitalized undertaking. The Directors only want some £1800; and the temptation they offer consists of twenty first mortgage 4½ per cent. "A" debentures of £100 each, at not less than £90 per cent., redeemable within seven years at 10 per cent. premium. This shows the unsubstantial credit of the Company. Those who originally and very foolishly supplied capital for the business and the promoters are apparently quite willing for others to speculate this time; but those shareholders will not be any the happier to learn that this debenture issue puts another bar between their original hope and realization. They will read in the invitation for tenders for these debentures the artfully worded statement: "The *receipts* of the Company are more than sufficient to meet the annual debenture interest." The Directors of the Company should exercise greater care in editing their invitations to the public to drop money into their coffers. They have made a miserable mess of dates this time. The prospectus says that tenders will be received up to noon, Thursday, May 14; at the side of the form of tender, it is stated that "*no* tender will be received after noon Tuesday, 12th May." Knowledge of Cannon Street promotions incorporates information as to the capaciousness of letter-boxes for the communications of people who are desirous of parting with their money on an extremely fragile security. Then in the body of the tender form appear the words "in accordance with the copy sale by tender form dated May 1, 1908; the prospectus is dated May 2. There is a confusion of dates here. Accompanying the prospectus is an article from a local paper, in which are given photographic views of the heavily capitalized gas-works. The views suggest that the works would just about answer the purposes of a coal-testing plant.

Commercial Analysis of Ferrocyanides.—At the meeting of the Society of Public Analysts held at Burlington House last Wednesday, a paper was read by Dr. Harold G. Colman on the above subject, with especial reference to the analysis of the crude ferrocyanide products obtained from coal gas. Dr. Colman discussed the methods most commonly employed for the analysis of these and similar products—viz.: (1) Direct estimation of the ferrocyanide present by titration with metallic salts; (2) indirect estimation by determination of the quantity of iron present, and calculating from it the percentage of ferrocyanide; and (3) by determining the amount of hydrocyanic acid present, and calculating from it the amount of ferrocyanide. The limits of accuracy of the methods and the precautions necessary to reduce the errors of analysis to a minimum were dealt with. The influence of the presence of carbonyl ferrocyanides on the analytical results was also considered, together with methods by which this impurity may be removed.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 391.)

THE Stock Exchange has had a rather disagreeable week, encountering at the very start an unlooked-for blow, from which it took all the rest of the week even partially to recover. However, it might conceivably have been much worse. The bolt from the blue which fell on Monday came from the East; the Indian intelligence indicating alarming possibilities in connection with Afghanistan, and announcing that Bengali malcontents had organized a factory for the production of infernal machines. The immediate effect here was that Consols fell more than a whole point; and Indian loans fell more than this. Other markets were ready to sympathize; and some of them had their own little weak spots too. Next day a calmer view was taken, and a partial recovery began; Consols picking up $\frac{5}{16}$, and some others shaping rather better. On Wednesday, the same process was proceeded with, aided by a good tone in the American Market and less gloom in Home Rails. Business was at very low pressure on Thursday; but markets were disposed to cheer up, and some of the gilt-edged division rose a little. Friday was inanimate—depressed by the Budget, which was not well received—and there was very little movement of any sort. Saturday was very quiet. Consols were fractionally lower on sales; but Home Rails inclined to be more cheerful owing to the fine weather. The Money Market throughout the week has been characterized by great ease. A superabundant supply was on hand, offering at low rates, and discount terms steadily relaxed almost from day to day. In the Gas Market, business was only about a moderate average, and without any remarkable feature. Changes in quotation were few and irregular, pointing to no general tendency. In Gaslight and Coke issues, the ordinary was very steady at the same figures as the week before. Once 94⅜ was marked; but all other transactions were within the limits of 94½-95¼. Of the secured issues, the maximum was not touched; the preference was done at 107½ and 108; and the debenture was active at from 83½ to 85. South Metropolitan opened unchanged, and afterwards touched 121¼; but thence it fell away, and closed with a mark of 118½—a drop of 2 in the quotation. The debenture realized 84½ and 85. In Commercials, the 4 per cent. was done at from 105½ free up to 107¼, the 3½ per cent. at 101 free, and the debenture at 82½ free. In the Suburban and Provincial group, Brighton original had a rise, changing hands at from 203¾ to 205; but Brentford old fell a point, with business at 244 and 241. British marked 41⅛ special, Bromley "A" 116¾ and 117¼, South Suburban 118 and 118½, and ditto preference 120½. The Continental Companies were quiet. Imperial was done at from 179⅜ to 181, ditto debenture at from 93¼ to 93⅜, Union preference at 142 and 143, Cagliari at 25½, and Tuscan at 10¼. Among the undertakings of the remoter world, Buenos Ayres changed hands at 11 11/16 and 11¾, Primitiva at 6¼, ditto preference at from 4 15/16 to 5, ditto debenture at 93¼ and 94¼, River Plate at from 13⅛ to 13⅜, and Oriental at 141 and 142.

ELECTRICITY SUPPLY MEMORANDA.

"The Poor Man's Light," but—The Small Householders will be Unprofitable—The Indifference of Electricity Meters to Small Consumptions—Revolt against "Scientific" Methods of Charging—Mr. Robert Hammond Prophesies—Efficiency of Electric Heaters.

THE phrases "the light of the future" and "the poor man's light" as applied to electric lighting have become antiquated, and are treated with disrespect now by those electricians who have had the sunny prospect they in the past conjured up very considerably clouded by substantial facts, the latest of which has reference to the metallic filament lamps. The situation that is being created by these for the central electricity supply undertaking, through reduced consumption for lighting purposes per consumer, reduced revenue per consumer, and what looks like an inevitable necessity for revising prices, in order to make up the deficiency of income, has been the subject of comment in the "Memoranda." The more central station engineers consider the financial effects of the metallic filament lamps, the more are they arriving at the conclusion that they are not among the men to whom these lamps have come altogether as a boon and a blessing. Prepayment meters, free wiring, and all the other methods of getting hold of the smaller class of householders, have proved financial failures—cost of installation from street cable throughout, cost of renewal, cost of electricity, all have operated against any great expansion in this direction. The metallic filament lamp was for a time received with open arms as at last bringing electric light within reach of the "poor man." The lamp necessitated for the well-being of the central station a bigger custom; the "poor man's light" was the cry to be revived. But there are more sides than one to this question; and more than once has another side been pointed out in the "Memoranda." The metallic filament lamp has not reduced any cost save that for electricity; and when the cost of supplying the "poor man" is taken into account—from the generating-station to the putting in of the service and meter—and the nature of his custom is considered, the question rises to the surface whether such consumers would not

produce, instead of a profit, a loss to an undertaking, the accumulations of which would make the latter state of the undertaking worse than its existing condition. The central station engineer, in a purely residential town, is not to be envied the troubles that, on all hands, seem, with a fair amount of certainty, to be in store for him. Now, the humble users of artificial light are not likely to be courted by him; and he will feel tolerably safe from their attentions on account of the cost of indoor installation.

The central station engineer will, through the use of metallic filaments, want increasing business; and these unprofitable small householders, who would bring upon the undertaking costs altogether disproportionate to their custom, have, as shown, added to the uncharitable conditions encompassing business at the present time. Were it not, as said already, that the cost of interior installation is a safeguard against such connections, these, for electricity, small unprofitable householders would be in a position to make things very uncomfortable financially. A benign Parliament, watching over the interests of residents in the area granted to an undertaking, have given anyone—the large and small householder alike—the right to a supply of electricity, if the premises are situated within fifty yards of a distributing-main, on the same terms as any other person in the area under similar circumstances, but there is a maximum price per unit imposed on the suppliers. So that the central station engineer has something for which to be thankful, in that internal installation cost, which is something that is not controlled by Act of Parliament, is a protection to him under present circumstances. The custom of this class of consumers, experience with carbon filament lamps shows, is of an extremely low order; and it will be lower still with the metallic filament lamps. It is only a very substantial reduction in the cost of providing a supply that would make them worth having by an undertaking, considering the costs of generating and distributing the electricity, and the capital cost of the service and meter. Only the other week, the Local Government Board told the ruling authority at Abertillery that they were not satisfied that an electricity undertaking would be a financial success in the district. It was estimated by the interested advisers of the local authority that a revenue of 6s. per 8-candle power lamp might be expected; but the Local Government Board looked upon this as an exaggeration in such a district, and regarded 4s. as a safer estimate. An 8-candle carbon filament lamp consumes nearly as much electricity as a 32-candle power Osram; and in a working man's cottage, probably one room—the kitchen, which is the general sitting-room—with a 32-candle power lamp in it would meet his requirements for the greater number of hours during which artificial illumination is ever required. That is not a profitable outlook, when the station engineer counts the cost of giving that workman his supply, and of measuring the current he uses. Metallic filaments of 8 and 16 candle power for the higher voltages are among the expectations of the future; and these, if and when they arrive, would make things considerably worse. There has been some talk of supplying the small householders at a fixed charge without a meter; but the advice to those who seriously entertain such an idea is "Don't." Honesty may be the best policy; but opportunity is looked upon as a fine thing by the human race. On the other hand, it is not likely that the small householder would agree to pay a fixed sum based upon his possible maximum demand, with a low price per unit in addition. Such crooked method of payment he would look upon as some strange and evil device specially designed for "doing him." The prepayment meter system with house equipment, with the low consumption of the metallic filament lamps, would only add to the unprofitableness of such householders through the greater capital expenditure involved.

The "Electrician" has lately discovered another trouble to add to the bundle of miseries of the electrical engineer. As we have said, the 8 and 16 candle metallic filament lamps, consuming (say) 1·3 watts per candle power per hour, for 200-250 voltages, are regarded as almost within grasp; and our contemporary has so little faith in electricity meters that a belief is entertained in a rather serious loss in the aggregate being produced for the electricity undertakers through the difficulty of metering such modest consumptions as would be obtained by using an 8 or a 16 candle metallic filament lamp. Such a lamp would make a respectable "night light" through the long hours of the winter nights, and run away with a decent amount of unmeasured current. Electricity meters have the bad habit of running slow; and though such pieces of registering mechanism have had many years' work expended upon them, they have not been brought to that pitch of perfection that the registration of such little consumptions can be relied upon. This is a factor that will have to be taken into account if low candle power high-voltage metallic filaments come into general use.

Reverting to the subject of charging, the consideration of the question of price to the small consumers naturally shows one of the weaknesses of the boasted scientific principles upon which the differential charges of the electricity supply industry are based. If a consumer is such an excellent customer of an electricity undertaking that the latter can supply him at (say) 0·75d. per unit, then pray what should be the proportionate charge to a poor householder, using at most at one time a nominal 50 or 32 candle power metallic filament lamp for an average of three or four hours per day the year through? We agree with Mr. W. M. Mordey, the newly-elected President of the Institution of Electrical Engineers, in the discussion on Messrs. Handcock and Dykes's paper (to which some allusion has been made more than once lately in the "Memoranda"), that the charging systems of the electrical industry have been based on a misunderstanding, and that the easy methods of the gas companies are preferable. To-day, the aspirants to an unattainable perfection in charging for such a commodity as electricity find the difficulty growing of giving a reasonable answer to such a plain question as was put on the same occasion, by Mr. Léon Gaster, "Why should the electrical companies tie the consumer up with a lot of agreements, when the gas companies make supply so very simple?" There were several speakers in the discussion who looked somewhat enviously upon the successful and simple methods of the gas companies in the matter of charging, but who now find it hard to turn their backs on their own discredited fancy systems, for which they fought tooth and nail in the past. There were several speakers, too, who —like Mr. Robert Hammond—were entirely in agreement with Messrs. Handcock and Dykes, "in ridiculing the idea of charging heating and cooking at a different rate from lighting."

That is one of the most sensible things said by Mr. Robert Hammond in the discussion. Other things were said by him that cannot claim the same distinction. His manner of statement and the character of his prophecy, should certainly qualify him to act as *locum tenens* for one writer of a weekly budget of electrical notes. We find him saying to the electricals at the meeting in question: "They were all acquainted with the fact that in many foreign cities, *gas had been entirely abolished;* and he would say to the English gas managers of to-day that their tenure was a short one. . . So long as the gas companies paid enormous dividends, he felt confident for the future of electricity, because it showed what an enormous field was open to electricity undertakers." The electricians present at the meeting no doubt wished they were acquainted with those foreign cities; and they, with us, would be interested in learning the names of such remarkable places. The prophecy, too, is not by many the first made by the, in imagination, doughty Mr. Robert Hammond; of the many, there are but few that have been fulfilled. He many years ago talked with equal glibness. We must say that the latter part of the quotation is really too flattering. Let us see, "enormous dividends" maintained on a flat-rate, by the cheapest light in the world, and with electricity in competition. The business ability that has accomplished so much is not going to let the gas industry go under because Mr. Robert Hammond, electrical expert and soothsayer, has said this thing will be—and what is more and fairly definite in a "short" time too.

One of the funniest proposals we have seen in connection with the new lamps comes from Beckenham. There the Electric Lighting Committee desire "clear" notice to be given by electrical fittings contractors to all whom it may concern that, as the total consumption for the district will for a period be reduced, for "a limited time" there may be a small increase in the charge per unit. The Electrical Press has been dancing unmercifully on the ill-conceived circular; and the authors have had such expressions as "dangerous policy" hurled at their heads, with doubts as to the statutory right to differentiate in the charges between consumers using electricity for like purposes, though the means of use may not be the same. It does seem a singular idea, on the part of the management of this undertaking, to penalize consumers for using more efficient appliances, and to discriminate between them and those using the old inefficient carbon filament lamps. Fancy the gas industry proposing to penalize the users of the latest and most efficient incandescent gas-lamps; and to supply the users of flat-flame burners at the old price! Another very curious thing is that a commercial industry should have been cutting things so fine in the past, that the first coming of more economical lamps should upset managements, and cause them to go to these extremes. There is room for inquiry as to the causes that have put electricity undertakings in some districts in such a position that their equilibrium is so easily disturbed.

The modern newspaper serves up to its readers notes upon technical subjects, written in a manner that all who run may read, and all who read, being of average intelligence, may understand. It is manifest that sometimes these notes are written by amateur hands, and are amusing and extravagant in the message they have to convey. The "Engineering Notes" appearing in the "Daily Telegraph" are not of this order. In them, however, occasionally we find that just where interest is being aroused, there is a hiatus in the explanation needful to help one to a full comprehension of the point. The writer of the notes the other day was treating of the subject of electrical heating; and he told his readers that, when we are converting 1 lb. of coal into electricity, the efficiency of the complicated effort is only about 10 per cent. When, further, we come to take the whole process of converting the heat units of the coal to the heat given out by an electrical heater, it is found that the efficiency of this process is only about 7 per cent. But a gas-range, it is stated, is "not very much more efficient; it may be taken at about 15 per cent." The negative in the sentence might well have been omitted; for the figures show that the gas-fire is, at any rate, over 100 per cent. more efficient than the electrical heater. Then the reader learns that if we work things out at the average current prices at which gas is sold, it is seen that "the unit of electricity must only cost about ¾d. in order to be more economical than gas for heating purposes." That is where the writer of the notes omits most interesting information. He does not say what he assumes to be the average current prices for gas; and there would be interest in seeing his calculations just to check the results. Regarding the relative heat efficiency of the electric radiator and the gas

fire, when the air is icy outside, for warmth and comfort we would rather sit in a room with one ordinary gas-fire, than in one with two or three four-lamp electric radiators. Practical experience goes further with the householder than academical studies of heat efficiencies.

NOTES FROM WESTMINSTER.

SINCE the Easter recess, a few miscellaneous gas and water matters have been before Committees; but about them there is not much novelty, or points to which reference need be made.

Unprofitable Prepayment Consumers. The Padiham District Council Bill has been under examination by the Police and Sanitary Committee; and the variation that they proposed to make in the model prepayment clauses was shown not to be acceptable either to the Local Government Board or to the Committee. It will be remembered that the Council sought power, where the consumption through prepayment meters does not reach 3000 cubic feet in a quarter, to levy an additional charge of 2s. for the hire of meter and fittings. Of course, there is argument as to fairness in this; but if there is to be a variation of this kind in the system, it should be followed to its logical end, and a return be made to prepayment consumers of the excess price they pay above a certain fixed consumption—the line being fixed at a consumption representing the excess paid on 3000 cubic feet *plus* 2s. But the slot meter is with us, and is popular; and it has become so without the aid of any complications of this sort. From the first publication of this proposal by Padiham, we have felt—however just it may be to the consumers who do pay their fair proportion of the extra expenses attaching to the system—that the popularity of the latter would be injured by the introduction of such a complication. The Committee have not allowed the new power; but the fresh authorization desired by the Council in other respects in relation to the gas undertaking has gone through practically in its entirety. An interesting point connected with the Padiham water supply is that the Council are supplying with water the outside district of Simonstone; and the Police and Sanitary Committee have now given the Council the exclusive rights of supply, notwithstanding any rights Burnley may hitherto have had in the matter. The Draycott and Long Eaton gas territorial dispute comes to mind in this connection. The Burnley Corporation Bill has also been before the Committee; but more of this in our next "Notes."

Miscellaneous. Several Bills have been been under discussion by the Unopposed Bills Committee of the Commons. Among them, the Garw and Ogmore Gas Bill; and the Committee saw fit to cut down the large capital sought by a round £10,000. Another measure that has been under the same scrutiny is the Camborne Water Bill; the chief point about which is that the promoters desired that the supply to elementary schools should be by meter. We can sympathize with this desire. There is much waste at such schools; but there are the sanitary aspects of the question. The Local Government Board objected to schools being treated in this matter in any other way than in the past—as a domestic supply; and the Committee concurred with them. A Committee of the House of Lords, over which Lord Cromer is presiding, commenced on Thursday the consideration of the London and District Electricity Supply Bill, the London Electric Supply Bill, and the London (Westminster and Kensington) Electric Supply Companies' Bill. We will give attention to the proceedings when further advanced.

Saving Daylight. The seriousness and monotony of affairs in the Committee rooms have been relieved by the proceedings on the Daylight Saving Bill, which has been referred to a Committee under the chairmanship of Sir E. A. Sassoon. The Bill proposes that the hour between two and three o'clock in the morning of each of the first four Sundays in April shall be a small hour, consisting of forty minutes only; while the same hour in four Sundays in September is to be reckoned as of 80 minutes duration. Greenwich and Dublin mean time are to be retained for purposes of astronomy and navigation, and in legal and parliamentary documents, unless otherwise signified. The Committee dealing with the Bill wish it to be known that they will welcome the evidence of objectors to this proposal to periodically in every year upset the even tenor of life's way by securing "economy" by making greater use of daylight. The economy might be nullified by the great losses occasioned by disturbance; and certainly those who vend the agents for artificial illumination will look with disfavour on the measure. Electric lighting concerns with their high priced electricity for lighting and their close-cropped prices for day power supply will breathe many anathemas against the promoters of the measure if—we emphatically repeat, "if"—it becomes law.

Visit of Japanese to Old Kent Road Gas-Works.—Fifty of the "Asahi Shimbun" tourists (including one of the ladies) visited the Old Kent Road station of the South Metropolitan Gas Company last Tuesday. The Superintendent (Mr. T. S. F. Gibson) conducted the party over the works; and they appeared to be much interested in the coal-handling and stoking machinery. Tea was served at the new Livesey Institute at the Canal Bridge entrance to the works.

MR. LEONARD KÖRTING ON HIS RETIREMENT.*

A VERY pleasant annual function—much appreciated by those fortunate enough to be favoured with an invitation to be present—is the dinner that follows the May meeting of the Imperial Continental Gas Association. As usual, after the proceedings last Tuesday—as reported elsewhere to-day—the Chairman of the Board (Mr. J. Horsley Palmer), the Directors, the Engineers and Agents at the various stations on the Continent, and the Secretary (Mr. R. W. Wilson) and the heads of departments of the London staff, offered a hearty welcome to a number of their friends, who thus had an opportunity of greeting the distinguished band of Engineers to whom is entrusted the care of the Association's vast interests abroad.

The after-dinner proceedings are, as a rule, of quite an informal character; but on the present occasion some slight notice of them may be taken in view of the interesting reminiscences in which Mr. Leonard Körting indulged when he was singled out by the Chairman to respond to the toast of "The Association's Engineers and Agents on the Continent."

Mr. Körting (who spoke with much feeling and in excellent English) said: I wish to offer my most cordial thanks for the toast which the Chairman has been good enough to propose, and which you have so kindly received, and for the flattering words which the Chairman spoke on my behalf at the meeting this afternoon. I am very gratified to have the opportunity of thanking the Directors once more for the kindness they have ever shown me since I have had the honour of serving the Association, and that has been a long while. It was in the year 1862 when, as assistant to my father, I came to London for the first time on the occasion of a meeting of the proprietors. I came over with the Agent of the Hanover station, Dr. Schneemann; and we then met all the great men of those days—the General Manager, Mr. George William Drory, and Mr. Leonard Drory, of Berlin, the father of so many renowned Engineers. Then there were the Managers of the other stations—Mr. Pepys, of Cologne, Mr. Grice, of Aix-la-Chapelle, Mr. Van Aken and Mr. Pauli, of Ghent, Mr. Etzerodt, of Brussels, Mr. Ledger, of Lille, Mr. Burls, of Antwerp, and (as a youngster among them) Mr. William Drory, of Frankfort. With shy admiration, I looked up to the Directors and especially to the Chairman, Mr. Wolverley Attwood; and I have never forgotten the moment when the Engineers were received by the Directors—not singly, as is done now, but all at the same time. There is no one left of the Directors and Engineers of those days, with the one exception of Mr. William Drory; and I hope to see the day when he celebrates his fiftieth anniversary as a Station Manager. Long is the row of Directors and Chairmen and Secretaries whom I have since met here from time to time—from Mr. Wolverley Attwood and Mr. Walton up to the present time of Mr. Horsley Palmer and Mr. Wilson. How distinctly do they live in my memory with all their peculiarities! What a number of recollections are connected with their names; and in general how is my whole life connected with the Imperial Continental Gas Association. When my father, in 1833, was entrusted with the management of the Hanover Gas-Works—on the recommendation, and under the superintendence, of his friend Mr. Leonard Drory—his first care was to take a wife and to procure a successor who received the name "Leonard," from his godfather, Leonard Drory. Therefore from my very first infancy the words "Board," "Association," "Drory," became familiar to my ears, and filled my imagination with deepest respect. The Hanover Gas-Works at that time was a paradise for children, as every gas-works is where large room is provided for future extensions; and for me it remained a paradise, for I married there, and had children born there, who found the same on the works that I had found. In short, every happy recollection of my whole life is connected with the Association and the Hanover Gas-Works. And so I now leave the works which I have known in their original state as constructed by the brothers Drory for a production of 40,000 cubic feet, and which have been enlarged under my eyes to one hundred and fifty-fold their original size, and the working of which I have brought to a certain perfection. To leave them, I can assure you, is not easy; it requires a firm resolution. But you see, times have altered. I got my results with handwork; and present-day social conditions require that handwork shall be abolished and machine work introduced. I am thus obliged to rely on other persons who understand this part of the work better than I; and whereas I was in the habit of having the full understanding and of bearing the whole responsibility, new times require new men. Therefore, it was better that I should go and try to live on recollections. My very dearest will always remain: "The Association and the kindness and friendship of my Directors and colleagues." I know that I speak with the hearty consent of all my colleagues when I say that we are all proud to serve the Association which deserves so well its prosperity. Nobody knows better than we Engineers how anxious our Directors are to adopt every real improvement in the art of producing and distributing gas; how well they understand the need for keeping the works in thorough good order; and not only the works but also the officers and the men. They all do their duty with zeal and real pleasure, for they know how

* The "JOURNAL" for Feb. 18 (p. 409) contained a portrait of Mr. Körting, and some particulars of his professional career.

generously their services are rewarded. Gentlemen, I am sure, the gas industry would not make such rapid progress, there would not be such an interesting life and strife for improvements, if the towns would themselves take the whole of the gas business into their own hands, and if the big Associations, with their clever and generous Boards of Directors, disappeared. Therefore I propose: "Long Duration and Prosperity to the Imperial Continental Gas Association; Long Life and Happiness to the Directors."

Needless to say, this speech was heartily applauded, and the toast with which Mr. Körting concluded it was enthusiastically received.

PERSONAL.

We are very pleased to be able to congratulate Mr. JAMES WHIMSTER, the Manager of the Armagh Gas-Works, on being appointed a Justice of the Peace.

Mr. F. G. BARTTER, an assistant in the Malvern Gas and Electricity Department, has been appointed as Assistant at the Bari station of the Tuscan Gas Company.

Mr. F. J. DIXON, the Water-Works Engineer to the Harrogate Corporation, has been appointed, out of 159 applicants, to a similar position under the Stalybridge, Ashton, and Dukinfield Water Board.

Mr. PERCY HULME HORNBY, who is engaged at the Brentford Gas-Works, has been elected a Fellow of the Chemical Society. He is the son of Mr. John Hornby, of the Nine Elms station of the Gaslight and Coke Company.

Mr. HIGSON, the Superintendent of the Lum Street Gas-Works of the Bolton Corporation, being now unequal to the responsibilities of the position, has been relieved of them, but his services have been retained at the works to perform such duties as the Gas Engineer (Mr. W. Smith) may require. He will be entrusted with the testing of the gas.

Readers will doubtless remember that, on the occasion of the annual dinner of the staff of the Birmingham Corporation Gas Department in March, reference was made to the approaching retirement of Mr. HENRY HACK, the Engineer-in-Chief. As a matter of fact, his connection with the department ended last Saturday; and he started yesterday for a holiday in Cornwall until the 29th inst., on which date his engagement will terminate by effluxion of time. He was Engineer of the Saltley works of the Corporation till 1902, when, on Mr. Hunt's relinquishment of his similar position at Windsor Street, he was appointed Engineer-in-Chief. It is not known what arrangements will be made in regard to the future management of the gas undertaking; but it is rumoured that Mr. Hack will not have a successor.

OBITUARY.

News has recently reached us of the death, early in February, of Mr. S. B. DARWIN, who was for about twenty years the Secretary and Manager of the Portsea Island Gas Company—a position he relinquished in July, 1898. Mr. Darwin joined the British Association of Gas Managers in 1867, when he was at Shrewsbury, and served as a member of the Committee. He passed into the Gas Institute, but left it on the formation of the first Institution. He was also a member of the old South-West of England and the Southern District Associations.

The death occurred on Saturday, the 2nd inst., at Egham, in his 54th year, of Mr. BENJAMIN HOWARTH THWAITE, whose work in connection with gaseous fuel and power has been followed by many of our readers. Deceased had been ill for some time, but not seriously until early in the present year. Mr. Thwaite was born at Brighouse, but spent much of his early life in Bolton, where he was engaged in municipal engineering, and subsequently in South Wales, under the late Sir William Siemens, where he acquired that knowledge and experience in metallurgy and fuel working which influenced his subsequent life. He was for some years in Liverpool; leaving that city for London nearly twenty years ago. He was a pioneer in blast-furnace gas utilization. Some years ago he advocated the transmission of electric power from the coalfields to London, and gave all the help he could to later developments of this. He was a partner in the firm of Messrs. Thwaite and Thorp, of Westminster.

De Brouwer Machines in Germany.—The "Journal für Gasbeleuchtung" for April 25 last says that the De Brouwer charging and discharging machines, which are built in Germany by the Berlin Anhaltischen Maschinenbau-Akt.-Ges., are finding continual extension in gas-works. In Hamburg, originally, one charging and one discharging machine were ordered for the Grasbrook Gas-Works. On the ground of experience there obtained, two more charging and discharging machines were installed in the works at Barmbeck, Hamburg. The results obtained in the latter place have led to such great savings that two more De Brouwer charging and discharging machines have recently been ordered; so that in Hamburg, as a whole, five charging and five discharging machines are at work.

COAL PRICES AND COAL REPORTS.

THE coal contracts for the two London Gas Companies north of the Thames have been practically completed. They may have fragmentary orders still to place; but they are definitely booked up now for the bulk of their requirements for the next twelve months, and so are practically out of the market. The South Metropolitan Company have simply made their position secure, but are holding off for the present from settling contracts. Their contracts, we believe, expired on March 31; but they have only made sufficient purchases for current and immediate needs. In the case of the South Suburban Company, so far as we can learn, the same policy is being pursued; and they are buying nothing at present, but just going on, as it were, from hand to mouth. Neither Company, it seems, have the slightest difficulty in getting all the coal they want. The continued inaction of the Boards of the two Companies shows that they are not in any degree perturbed by the swagger of the coal papers, instanced by such articles as have appeared in the "Iron and Coal Trades Review" and the "Coal Merchant and Shipper." Articles such as those we have in mind are evidently framed with the intent of inducing buyers to close for their requirements; and there is little truth in such statements as were made by the former paper, "That the collieries are emerging victoriously from the struggle which has been in progress lately between buyers and sellers as to the prices at which gas coal contracts should be made this year. . . . . The gas companies are now anxious to come to terms, having recognized that the reverse is likely to happen." Buyers past, and buyers prospective, know that the anxiety has been on the other side. They know with what praiseworthy pertinacity representatives of coal sellers have been waiting on the office doorsteps, anxious to do business. There has, we admit, been a temporary show of firmness all round on the part of those instructing the coal representatives—whether representatives of Durham, Yorkshire, Lancashire, or other coal centres—but the tall talk of Yorkshire coal owners in the early part of the year, respecting the maintenance of the same prices as last year, the round table conferences in various centres, and the resolutions of the Gas Coal Federation to make only a concession of 1s. a ton, what of them now? They have, with all the attempted combination, come to naught. The lesson has been learnt that the gas undertakings are powerful. Losses have a lingering tendency in memory; and the evidence that was afforded the coal owners last year of the mobility of gas coal contracts, when an insufferable oppression is threatened, has introduced a factor into the situation which—when there are not booms to back them up, and when a marked shrinkage in the trade of the country is proceeding—coal owners, in their personal interests, cannot afford to treat with indifference. The result is that, with all the brave show at a resolute stand to maintain prices when in conference assembled, the loss by individual owners of good steady contracts last year, the sight of contracts possessed last year going to other hands this year, and the uncertain cloud hanging over the future, have had the effect of producing greater flexibility of opinion.

Looking upon all sides of the situation, every support is found for the policy of the South London Gas Companies. The eagerness to secure contracts of which buyers have had such a strong manifestation the last few weeks is one phase of the position. Another is that the monthly return issued last week, reflecting the condition of trade in the country, shows a drop of many millions since the beginning of the year in our total imports and exports. Those in close touch with the conditions of trade in the North (especially in the shipbuilding, engineering, and iron industries) know well of the drop there has been in the home requirements for coal—a drop that is not by any means counterbalanced by the demands from abroad, on which foreign demand the hope of maintaining prices is insecurely anchored. Considering all the conditions, we discern no cause for a shadow of doubt that the gas undertakings which, like the South London Companies, have been holding their hand in the matter of contracts will not have any difficulty in meeting their requirements, or hereafter have any cause for regret. No risk can be seen that is being run by them. As a matter of fact, there are owners who are already bitterly disappointed that they have not again booked the large contracts (some have secured small orders) over which they were successful last year; and, having regard to the trade outlook, the chances are that rather than see other good and (for delivery) constant contracts floating away from them, they will do the wise thing, and endeavour to get possession by coming still nearer to buyers' views. We feel pretty confident, from what is heard in different parts of the country, that had more gas coal buyers stayed their hands, the position would have been easier than it is to-day. Enough, however, has been seen not in the columns of the papers devoted to the coal industry, with their loyal support of attempts to hurry on buying and bolster up prices, but in gas board rooms, committee rooms, and offices to fairly well gauge the true position.

Concerning the prices that have been paid. "It is now apparent," says the "Iron and Coal Trades Review" "that the collieries are emerging victoriously from their struggle." Let us examine, in the light of cold facts, the character of that victory. Conferences of coal owners resolved to adhere to last year's contract prices for gas coals; others, to magnanimously recede 1s. per ton in view of the prospect of easier conditions. The bulk of the Gaslight and Coke Company's contracts have gone to Durham;

and the prices paid by them and the Commercial Company have been 10s. to 10s. 6d. per ton, and for special sorts round about 11s. The Imperial Continental Gas Association have bought at about 2s. per ton less than last year; and reports from several other quarters show that contract prices have receded 1s. 6d. and 2s. per ton on last year's figures, and for moderate quantities too. Actual facts are the evidence that the coal owners have not succeeded with the ambitious views framed during the early weeks of the year. They may be forgiven. The early weeks of the year constitute the season when resolutions are made that are sometimes so terribly hard to keep later on. The prices of to-day brought into contrast with those resolutions do not show that triumphant emerging from the contract struggle in which the coal papers would have us believe. The only triumph that is really felt is that engendered by the securing of contracts; but in other quarters, colliery owners fail to appreciate any great cause for a pæan to the note set by their trade organs.

Warning has before been given in our columns that quotations in prices for coal given in market reports—no matter the source of publication—should be treated as "quotations," and not as bed-rock prices. It should be remembered that the correspondents in the coal centres are in touch with the sellers, and not with the buyers. Our own Northern Coal Trade correspondent last week stated that "prices of Durham gas coal vary according to quality—from about 10s. 9d. to 11s. 6d. for the usual kinds, and from 12s. to 12s. 3d. per ton f.o.b. for 'Wear specials.'" Lower down in the same report, he stated that the gas coal contracts so far settled for London [not including the South London Companies] had been at prices from about 10s. to 10s. 9d. f.o.b., according to quality. The difference between the quotations and the contract prices is seen in this one report. Again, in "The Times" market reports last Friday, under the heading Newcastle, it was stated that "colliery quotations for prompt may be taken as follows: Special gas, 12s. 6d.; New Pelton or Holmside, 11s. 6d.; and seconds, 11s." "The Times" reports are usually fairly reliable; but it is difficult to understand these figures, seeing that the London Companies have not paid more than 11s., or its equivalent, for what is called special, or the best Durham gas coal, and for other sorts down to 10s. or a trifle lower. Newcastle coal, we know positively, has been purchasable at these prices during the past few days.

Enough has been said about the situation respecting the London contracts, and the general position, to serve as a guide to others who have been, and are still, pursuing a waiting policy. But we cannot leave the subject without a concluding sentence or two that we hope may have some effect. Would it not be to their general interest for the coal owners to adopt a more reasonable attitude towards the gas industry? The coal owners—if they reflect on times good and bad, if they reflect on the position of the gas industry as large and steady buyers in all times (whatever the condition of general trade), if they reflect on the antagonism that their ineffectual combinations provoke, and if they reflect on the marching orders of three months ago and the extent of the want of success of those orders—may see that there is beneath the question much worth their consideration. A really reasonable attitude would be reciprocated in the gas industry.

INSTITUTION OF GAS ENGINEERS.

The Visit to Berlin.

When noticing, in the last number of the "Journal," the arrangements for the annual meeting of the Institution of Gas Engineers, it was mentioned that the Council had accepted an invitation from the German Association of Gas and Water Engineers to visit Berlin at the conclusion of the meeting, for the purpose of inspecting the new gas-works of the city, and especially the installation of vertical retorts. We learn that the party will leave Liverpool Street Station at 8.30 p.m. on the 18th of June for Harwich, where the steamer, on which berths will be reserved, will start for the Hook of Holland, which will be reached early next morning. The restaurant car train, upon which breakfast and luncheon can be taken, will leave about six o'clock, and is due to arrive in Berlin (Friedrichstrasse Station) just before seven in the evening. On Saturday, the 18th, motor-cars will be provided to convey the party first to the Oberspree and subsequently to the Mariendorf works. At the invitation of the Imperial Continental Gas Association, the party will partake of luncheon, at the close of which the works will be inspected. In the afternoon they will be invited to take a trip by steamer through the Teltow Canal to Wannsee, one of the finest riverside suburbs of Berlin, where they will be the guests at dinner of the German Association. They will leave by train at 9.30 p.m. for Berlin, to inspect the high-pressure inverted street lighting. Sunday will be left open. On Monday, motor-cars will leave the hotels at 9 a.m. for Tegel, for an inspection of the municipal gas-works, returning to Berlin at 1 p.m.; and the members will have the afternoon and evening to themselves. On Tuesday, they will commence their return by the 11.32 a.m. restaurant train for the Hook of Holland, whence the steamer (on which berths will be reserved as before) will leave at 11.20 p.m. for Harwich, arriving early next morning. A breakfast car is attached to the 6.30 a.m. train, which is due at Liverpool Street at 8 a.m. Having regard to the purely technical nature of the visit, it has been decided not to make any arrangements for ladies to join in the excursion.

ROUND THE WORLD—AND SOME GAS-WORKS.

By Maurice Graham.

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Introduction.

The writer has no intention of attempting to issue a guide book, nor will he in any way attempt criticism, but will confine himself to a description of that part of the tour round the World he is making which he considers may be of interest to readers of the "Journal." He wishes, at the outset, to acknowledge the friendly welcomes that have already been so kindly accorded him, and also to express his thanks for the information so freely given. Needless to say, where matters have been touched upon that necessarily involve a judicious reserve, the confidence shown will be most strictly respected.

The writer purposes spending twelve months in visiting Egypt, India, Burma, Ceylon, Australia, Tasmania, New Zealand, Fiji, Samoa, China, Japan, the United States of America, and across the whole length of Canada from Vancouver to Quebec, and so to Liverpool.

A start was made on October 19 last, when the writer left Tilbury on the P. & O. s.s. *Caledonia*. The newspaper placards in London that day announced storms and shipwrecks; so that things, as regards weather at all events, did not look very promising. And so it proved; the worst anticipations being realized in the Bay of Biscay. The traveller's usual adventures and experiences on board can be passed over. But a word of advice to intending passengers may not be out of place. It is this. They should really book their berths when they are born. Otherwise, the shipping companies try and persuade them the best berths are all full up. Another word of advice. Study well the boat-plan before booking; and choose those positions where the fearful noise caused by the suction of the water down the scuppers can be avoided.

What need to describe the usual P. & O. crowd of passengers—military men and their families; East Indian merchants and their clerks; tea planters; and—Diabolo players.

Marseilles was reached in five days—and pouring rain. When only a day out from that port, a Mediterranean tidal wave fairly swamped the boat, and cabins were twelve inches under water. However, at last Port Said was sighted. Then came the usual Customs' struggles and "backsheesh" demands. And so to the delights of a desert train journey for five hours in a fog of sand, notwithstanding all doors, windows, and cracks being closed.

I. EGYPT.

Port Said and its Gas-Works.

Photograph No. 1.—Port Said—View of Quay.

Photograph No. 1 shows a view of the quay opposite where the vessels anchor. The lights on the quay do not attract attention; so that one can surmise that not much money is spent on illumination at present. The authorities appear to rely chiefly

Photograph No. 2.—Port Said Gas-Works.

upon the reflected light from cafés and restaurants for the lighting of the roads. Otherwise, the public illumination is effected by incandescent gas-burners. But there are really only about six streets to be lighted; and it cannot be said that they excel with brilliancy of light. Port Said, however, is in its infancy; and the

gas concession must be a valuable one. It is held by a well-known French Company—the Cie. Centrale d'Eclairage et de Chauffage par le Gaz, which is even better known by the name of MM. Eugène Lebon et Cie. To them belong five gas undertakings in Egypt—Alexandria, Cairo, Port Said, and two others. The works are small; and nothing much need be recorded about them. But when one sees, as at Port Said, the enormous extensions that are being made in shipping facilities for dealing with the heaviest and largest steamers, the great financial prospects looming in the near future can be realized.

Photograph No. 3.—Retort-House and other Buildings.

Two or three photographs will suffice to give the reader an idea of the small gas-works at present existing. Photograph No. 2 gives a general view of the works; while in No. 3 the retort-house, purifier-house, and other buildings can be seen. The two little gasholders appear in illustration No. 4.

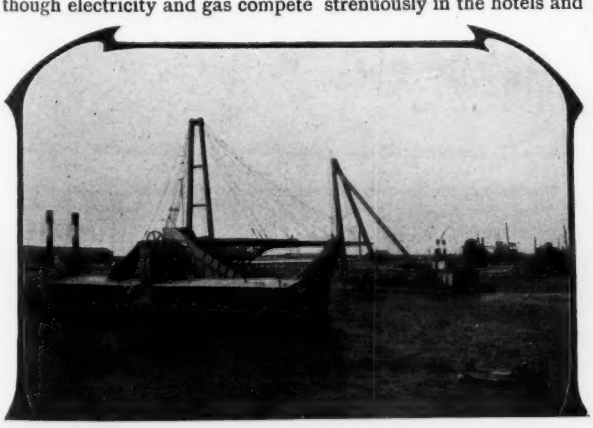
A photograph of some interest to makers of conveying plant at home is next reproduced (No. 5). This shows the large dredger at work dredging the Suez Canal; the material being deposited on the bank by the long outstretched beam. The view was taken at the actual entrance to the Canal.

Cairo and its Public Lighting.

Cairo is at last reached at half-past eight in the evening; so

Photograph No. 4.—Gasholders.

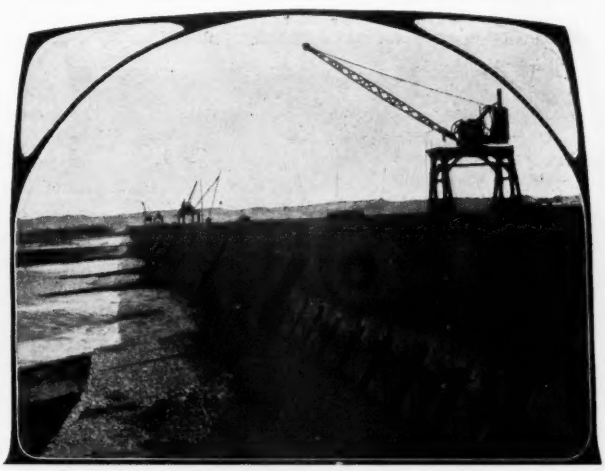
that a good opportunity is afforded of inspecting the lighting of the city. In general, it is adequately effective. One noticed high cluster lights, but not high-pressure lighting. However, the authorities are fully alive to the fact that their city is ranked among the gay ones of the world; and therefore brilliancy of illumination is absolutely necessary. Nevertheless, oil-lamps are still the general method of illumination in the shops and bazaars, though electricity and gas compete strenuously in the hotels and



Photograph No. 5.—Entrance to the Suez Canal showing the Dredger.

houses, &c. The writer had a good opportunity of contrasting these competitive illuminants in the grounds of the British Agency at a reception given by Sir Eldon and Lady Gorst. It is satisfactory to say that gas held its own in competition with its rival; festoons of Japanese lanterns and fairy lights giving beautifully coloured effects.

The general design of buildings in Cairo is Italian, reminding one of Genoa and Milan—in fact, the building contractors are mostly Italian or French, which partly accounts for the large, lofty, and airy apartments of the houses. Gas cooking-stoves are not in general use, as the native cook in all houses still cooks by the charcoal fire. It is really wonderful to see what splendid dinners these chefs can achieve with their charcoal, which, when



Photograph No. 6.—Assouan Dam, showing Foundations for Extensions.

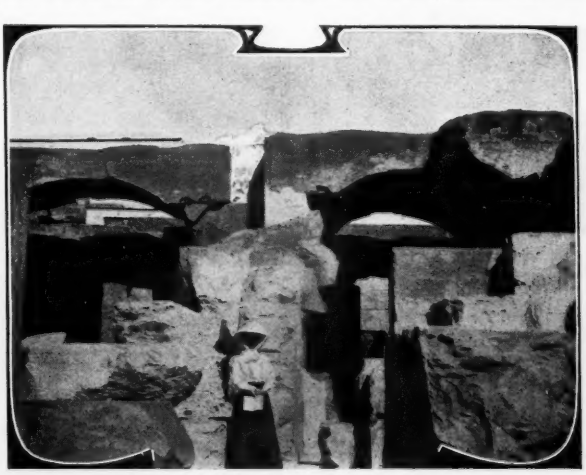
not required, dies out. Only at the largest hotels have gas-cookers been introduced as yet.

Up the Nile—Tombs and Temples.

Previous to going up the Nile, the writer had the advantage of visiting the interior of the Pyramids with Dr. Platt, who has studied Egyptian archæology for twenty years. He was travelling

Photograph No. 7.—Engineers' Village as seen from the Assouan Dam.

as physician to the Duke of Devonshire, whose recent death before reaching home has been so greatly deplored. Oil-lamps, candles, and magnesium wire are used for lighting purposes. Here was the wonderful work of 5000 years ago; yet the joints of the walls in the Queen's Chamber in the large pyramid were so

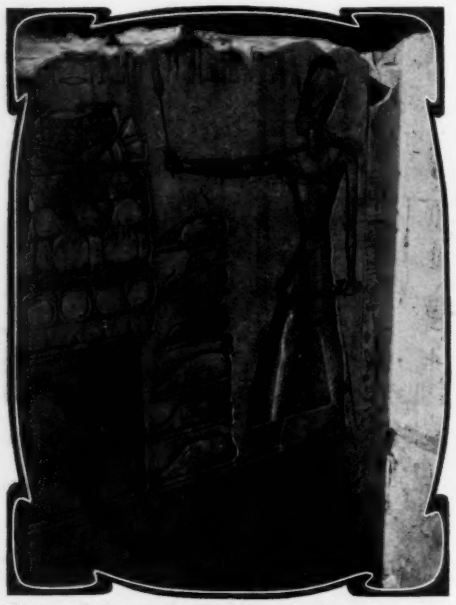


Photograph No. 8.—Temple of Sethos I. at Abydos. The Curved Roofing is Shaped from the Solid Stone.

finely ground that it was impossible to get the blade of a knife in them. They were, in fact, even finer than the joints of fire-brick work as some say it should be—but never is, except on paper!

The Nile steamer *Rameses* carried an interesting, varied, and motley load of passengers—British, American, German, French, Dutch, Italian, and South American. One was never tired of hearing the same language too often. The dragoman was an

Arab, and knew his business of describing tombs and temples, as well as selling modern British-made articles as Egyptian antiquities. The antiquity trade is better than gold mines or gas-works. The steamer stops for a few days at Luxor (Thebes), for the purpose of allowing travellers to see the ruins of the once magnificent temples of Karnak, Luxor, and others, and the glorious tombs of the kings. The last are lighted by electric light, generated by a small suction gas-plant and dynamo, hidden in the mountains far



Photograph No. 9.—The First Gas Cooking Stove. [?]

away from habitation. The Egyptian Government should light up all other places of interest instead of giving one a wretched candle by which to find one's way along underground passages and among tombs of great beauty and archæological interest. The Government charge £1 4s. for a licence-ticket to visit the antiquities of Upper Egypt. This pays for their protection and for lighting.

Photograph No. 10.—A Relief showing the "Chef" and "Cooker" on the Alabaster Wall in the Temple of Rameses II. at Abydos.

The Nile villages, when lighted at all, are lighted by oil. At the larger ones, however, such as Luxor and Assouan, there is feeble electric light. At the latter place was seen the now famous dam, and the new foundations for the extensions (Photograph No. 6). An idea of the engineers' village in connection with it can be obtained from Photograph No. 7. At Abydos, the Temple of Sethos I. was interesting from the constructional point of view, because, although the interior of its roof is curved, the stones that form it are in one piece, and are shaped out of the solid (Photograph No. 8). There are, of course, no examples of built-up archways; for these came much later, and are certainly due to the Romans.

The First Gas-Cooker.

In the Temple of Rameses II., at Abydos, a most interesting discovery to the gas profession was made by the writer. There, on the alabaster polished wall, was depicted a gas cooking-stove, with fowls, ducks, joints, bread, fruit, &c., and at the side of it another pile of food ready for cooking. The chef stands next to the stove, with his cooking utensils all ready to commence his duties. Inventors of gas-cookers can truly say "there is nothing new under the sun," after this one of 3000 years ago. This discovery of the writer's so satisfied him for the day that little else interested him. Surely the everlasting argument as to who was the originator of gas can now be bye-passed when the reader sees these photographs (Nos. 9 and 10). The next gas-cooker brought out should be called "The Rameses—the first on the market."

After seeing all the antiquities up the Nile, one realizes how small a thing man is after all, and that nothing really has been invented for thousands of years, but that only improvements in the methods of manufacturing machinery have been effected. Every method of working stone, metal, and wood, for agricultural and for building purposes, drilling holes, turning, &c., are depicted on the walls of the ancient tombs at Sakara. The secret of

Photograph No. 11.—On the Road to Denderah. An Automatic Lever Water-Lifter.

hardening their metal tools appears to have been lost. But they were able to drill holes, 1½ inches in diameter and 3 feet deep, into the body of granite and alabaster for the purpose of making sarcophagi. The writer saw the drill marks in rock. So that if only copper tools were used, they must have had "corundum" points for their drills, as Professor Flinders Petrie has pointed out. Also of great interest to the modern mechanical man—and the water engineers—is the ancient lever water-lifter shown in Photograph No. 11. Still more so, perhaps, is the one-camel power bucket-elevator photographed (see No. 12) when on the way to

Photograph No. 12.—An Ancient Elevator with Wooden Gearing.

Thebes. There one sees possibly the earliest form of wooden gearing, and exactly the same principle of elevating that, after thousands of years, is in use to-day in gas and other works all over the world.

The writer returned to Cairo, and then once more to Port Said, where he boarded the P. & O. s.s. *Persia* for Bombay.

P.S.—On looking through the list of passengers who had signed the dragoman's (Gladius') book of testimonials on the s.s. *Rameses*, the writer found the names of Mr. and Mrs. Dempster (of Manchester), and the autograph of his old friend, the late Mr. E. W. T. Richmond. He had evidently missed the gas-cooker picture, for otherwise it would have been published before now.

M. G.

(To be continued.)

Manchester and Yorkshire District Junior Gas Associations.—Arrangements have been made for a joint visit of the members of these Associations next Saturday to the coke-oven and bye-products works of Messrs. Ingham, at Thornhill, near Dewsbury.

COKE-OVENS WITH BYE-PRODUCT RECOVERY IN SOUTH WALES.

By HAROLD G. COLMAN, Ph.D., M.Sc.

Some little time ago, my attention was called by Mr. R. Forbes Carpenter, the Chief Inspector of Alkali Works, to a recent installation of coke-ovens at the Bargoed Pits of the Powell Duffryn Steam Coal Company, which presented many points of interest, both as to the construction of the plant itself and the nature of the manufacturing results obtained. By the kind permission of the Company, I was recently enabled to visit and inspect the plant; and, as the results obtained there have an important bearing, both on the question of carbonization and also on the utilization of gas in large engines, some account of the installation may be of interest to readers of the "JOURNAL." A complete and very fully illustrated description of the plant and of the results obtained has been recently given by Mr. E. M. Hann, the General Manager of the Company, in a paper read last autumn before the South Wales Institute of Engineers, and published in their "Proceedings" for Jan. 8 last (Vol. XXV., No. 6), from which paper most of the information given below and the illustrations are taken, and I must express my thanks to Mr. Hann and to the Institute for their kind permission to reproduce them.

The primary object in the introduction of the plant was the utilization of the small coal obtained at the Bargoed Colliery. Two seams of very different quality are worked, known as the Ras Las and Brithdir seams; the following being an analysis of the clean coal in each case:—

	Ras Las Seam. Per Cent.		Brithdir Seam. Per Cent.
Fixed carbon	80·20	..	70·50
Volatile matter	16·25	..	26·00
Ash	2·90	..	2·60
Moisture	0·65	..	0·90
	100·00	..	100·00
Sulphur	0·80	..	2·60

The Ras Las is a steam coal and the Brithdir a gas coal; but the former has exceptional properties for a steam coal, inasmuch as, though it contains only 16 per cent. of volatile matter, it readily yields 10,000 cubic feet of gas per ton when carbonized, this gas having a calorific power of about 460 B.Th.U. gross; and it has been found possible to successfully manufacture coke from the coal with only a relatively small admixture of the richer Brithdir coal. In actual work, the proportions used are about three of the former to one of the latter; the small coal from each seam being mixed in these proportions at the washery, where it is screened into five different sizes, each of which is separately washed. The three larger sizes are sold, and only coal of 5-16th inch and less is sent

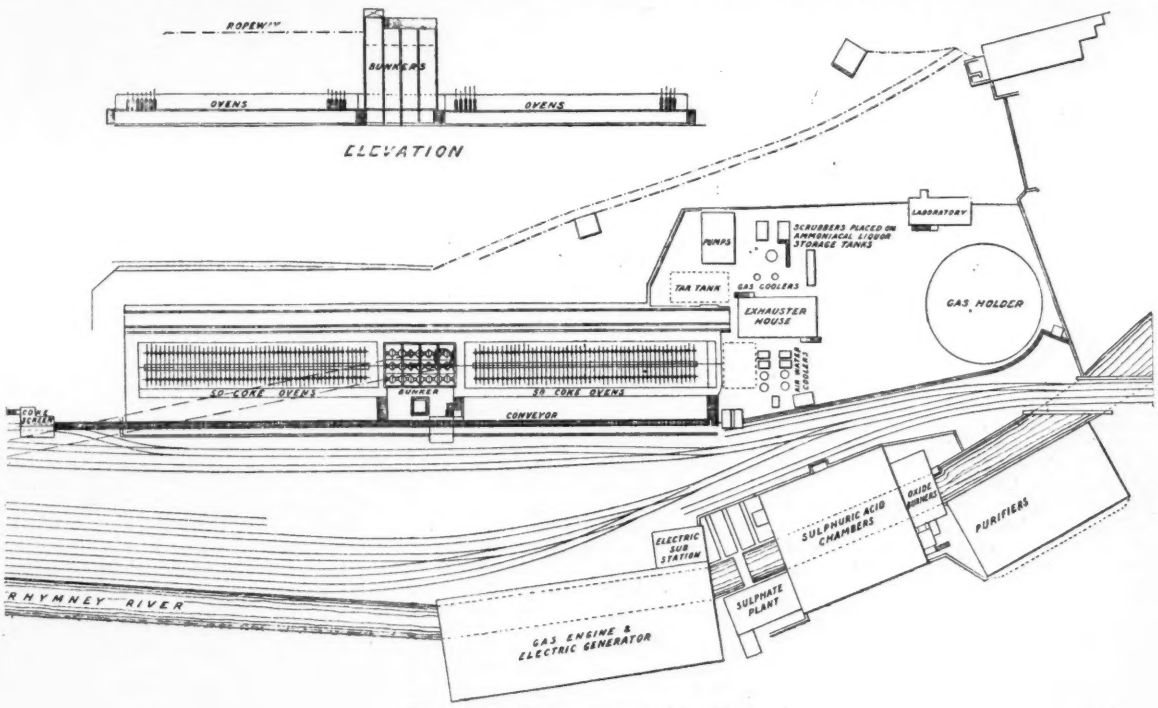


Fig. 1.—General Arrangement of the Plant.

to the coke-ovens. This is drained in large bunkers for 18 hours; the amount of moisture being thus reduced to 10 per cent. The coals used vary; but, on an average, the amount of ash is reduced by washing from 20 to 6 per cent., and the sulphur from 1·5 to 1·1 per cent., and the average amount of volatile matter in the dry small coal as coked is 19·5 per cent.

A general plan of the coke-oven and bye-product plant is shown in fig. 1, and is self-explanatory. The works, as will be seen, stand on both sides of the River Rhymney, which forms the boundary between Monmouthshire and Glamorganshire. Some of the plant extends right across the river, and has the rather unique feature of being partly in England and partly in Wales. The coke-ovens are 100 in number, and are of the Koppers regenerative type; the general principles and construction of which were described by Mr. Paul Schlicht, in his paper read before the Institution of Gas Engineers in Dublin last year.* The first set of 50 were put to work in November, 1906; and the second set (a similar number) in October, 1907; the chief difference between the two sets being in the arrangement of the regenerators. In the first set, four regenerators common to all the ovens are placed longitudinally along the full length of the bench; while in the second set a separate regenerator is provided under each oven. The latter plan, while being more costly, has the advantage that any oven can be readily isolated from the rest for repairs; and it is also found that higher temperatures can be maintained in the ovens with the latter arrangement. (Sectional illustrations of the second set of ovens are given in fig. 2).

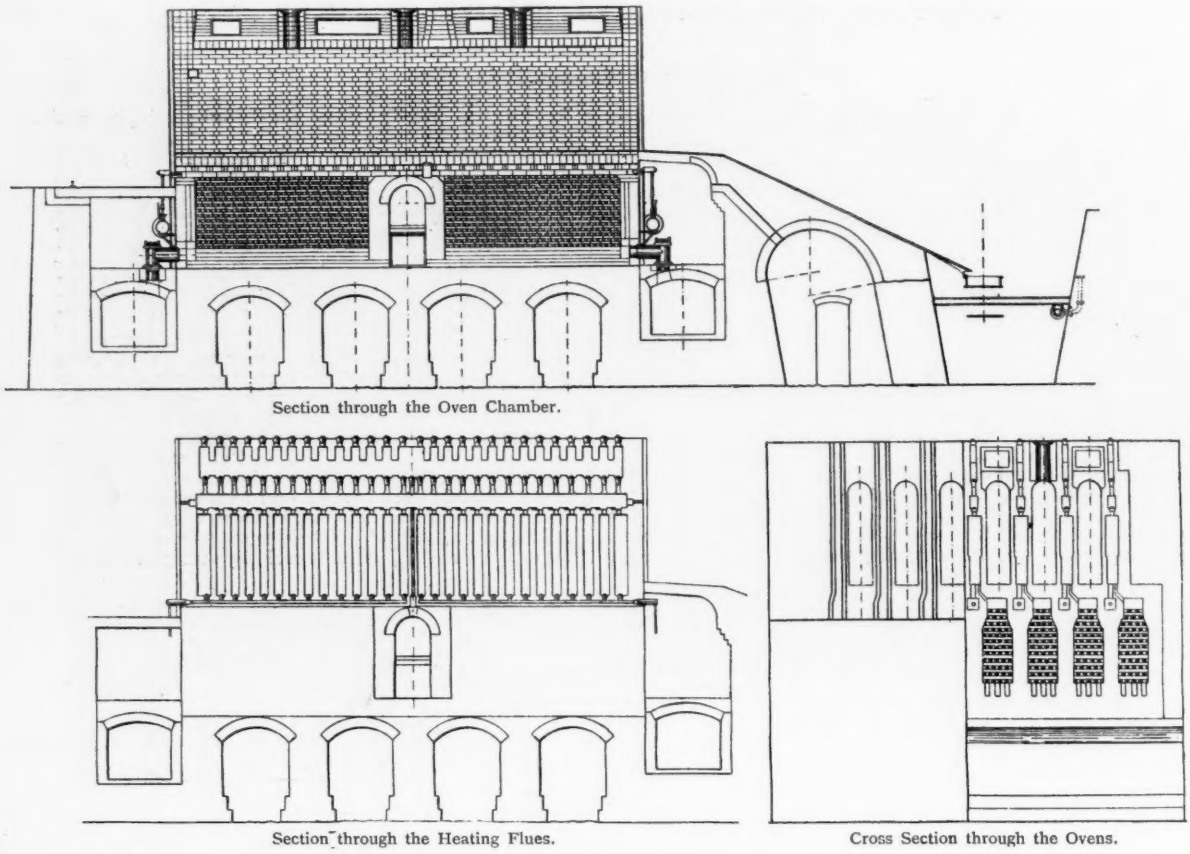
The charging of the coal is effected from hoppers at the top, and the charge is levelled by hand—no compression being employed. The average weight of the charge is 137 cwt. of wet, or 125 cwt. of dry coal; and the average period of burning is 27·9 hours. In the first set of ovens, the gas passes through a seal in the hydraulic main; whereas in the second set a dry main is employed. Some slight difficulty is experienced with thick tar—the dry main giving, perhaps, less trouble in this respect; but in both cases it has been greatly minimized by returning to the main some of the crude tar products from the tar-distillation plant. The gas passes through the usual condensers, exhausters, and scrubbers. The portion which is not returned for heating the ovens is purified with oxide of iron, and then passes to a Gadd and Mason spiral holder, sufficiently large to compensate for the fluctuations in the supply and demand. From a gas manager's point of view, it is interesting to note that naphthalene trouble in the condensers and scrubbers is by no means unknown; but it is hoped to overcome this entirely by the use of suitable tar distillates in those pieces of apparatus.

Turning now to the results, the chief product in such a plant is, of course, the coke. On an average, a yield of 81·75 per cent. of the dry coal is obtained, the average analysis of which is—

	Per Cent.
Fixed carbon	91·76
Ash	7·84
Moisture and volatile matter	0·40
	100·00
Sulphur	0·91

It is bright, hard coke, giving an average crushing test of 1821 lbs.

* See "JOURNAL," Vol. XCVIII., p. 974.



Section through the Oven Chamber.

Section through the Heating Flues.

Cross Section through the Ovens.

Fig. 2.—Regenerator Coke-Ovens.

per square inch. It is pushed out from the oven by means of an electrically-driven ram, passing first through a Darby quencher, where it is cooled in an atmosphere of steam, thus preserving its brightness, and then falls down the slope shown in fig. 2 into the coke-conveyor, which carries it to the screen, where it is separated into 80 per cent. of large coke and 1·75 per cent. of breeze.

As would be expected with so low a percentage of volatile matter in the coal, the yield of tar is small, only amounting to 36·5 lbs. per ton, the distillation of which is carried out on the works. The yield of sulphate of ammonia is 19·5 lbs. per ton. It is manufactured from the liquor in a Wilton plant; the whole of the sulphuric acid required being obtained by the burning of spent oxide and of the waste gases from the saturators. Incidentally, it may be mentioned that the Powell Duffryn Company, like Mr. Tysoe and others, have found that the burnt oxide may be used over again in the purifiers, for which purpose it is first made alkaline by moistening with ammoniacal liquor.

The total average yield of gas is slightly over 10,000 cubic feet per ton, the composition being as follows:—

	Per Cent.
Carbon dioxide	2·01
Oxygen	0·42
Carbonic oxide	5·21
Ethylene	0·80
Hydrogen	63·42
Methane	23·14
Nitrogen	5·00
	100·00

The calorific power of the gas is 460 B.Th.U. gross; the percentage of hydrogen being unusually high, due to the somewhat abnormal character of the Ras Las coal. In a flat-flame burner, it burns with only a slightly luminous flame, but gives excellent results in incandescent burners with properly regulated air supply.

Numerous tests have shown that of this gas almost exactly 50 per cent., or 5000 cubic feet, is used in heating the coke-ovens. The number of heat units employed for this purpose amounts, therefore, to $5000 \times 460 = 2{,}300{,}000$ per ton. The corresponding quantity of coke, taking the calorific power of the latter as 13,000 B.Th.U. per pound, would therefore be 177 lbs.; so that the fuel account corresponds to a consumption of rather more than 1·5 cwt. of coke per ton of coal carbonized. As the latter only contains 19·5 per cent. of volatile matter, one would expect that less heat would be required for its decomposition than in the case of coal containing from 25 to 30 per cent. of volatile matter; but even making due allowance for this, the consumption of fuel is a very low one. On account of this low consumption, there remains a surplus of 5000 cubic feet of gas per ton, which is available for use in place of small coal for firing the boilers, and more especially for employment in gas-engines.

By the adoption of this plant, it is estimated that only 10 per cent. of the energy in the small coal used is lost—viz., 8 per cent. in the shape of fuel employed in the heating of the ovens, and 2 per cent. in the shape of coke breeze, which, however, is used with other waste fuel to raise the steam required for the sulphate of ammonia plant. The remaining 90 per cent. makes its appearance in the form of 80 per cent. of coke, 8 per cent. in gas used for power and fuel, and nearly 2 per cent. in tar and sulphate of ammonia.

The sulphur in the coal used is accounted for by Mr. Hann as follows: This contains, on the average, 1·1 per cent., or equal to about 25 lbs. per ton of coal. Of this the sulphur in the coke accounts for 0·72 per cent., or 18 lbs.; while the liquor contains the equivalent of 2·3 lbs., much of which is recovered in the waste gases; and the spent oxide yields a further 2·7 lbs. This leaves a deficit of 2 lbs. per ton of coal, which is accounted for by the sulphocyanides, &c., in the waste liquor from the ammonia stills, and by the sulphur compounds not removed from the gas. This question of the sulphur balance-sheet is, I understand, being dealt with by Mr. Forbes Carpenter in his annual report for 1907.

With reference to the financial results obtained, naturally no detailed information can be published; but it may be stated generally that they have been satisfactory to the Company. The accounts of the coke-oven installation are kept quite separate. The small coal is charged to the plant at the current price quoted on the Cardiff Coal Exchange; and the revenue from the sale of coke, tar-products, and sulphate of ammonia is credited to the plant. There is also the credit to be given for the surplus gas used by the colliery for fuel and power. The value of this is calculated from its heating value, as compared with that of the small coal used for firing the boilers. This has a calorific power of about 12,000 B.Th.U. per pound; so that of the gas, of 460 B.Th.U. per cubic foot, 58,500 cubic feet equal 1 ton of coal. With a low price of 5s. per ton for the latter, the value of the gas on this basis is about 1d. per 1000 cubic feet; and it has been found, in actual practice at Bargoed, that with water-tube boilers the same percentage efficiency is obtained with both forms of fuel. Taking into consideration, however, the lessened stokers' and ashman's wages where gas is used, and the greater ease with which the correct amount of air to the furnaces can be regulated in the latter case, Mr. Hann is of opinion that the relative value of the gas is more nearly represented by 2d. than by 1d., and the credit actually allowed to the coke-oven plant is 1·5d. per 1000 cubic feet. The problem before those in charge of the plant is therefore to make a profit, paying for the small coal at Cardiff Exchange prices, and putting gas into the holder at 1·5d. per 1000 cubic feet; and this task they are successfully achieving. While admitting that the conditions at a gas-works are very different from those prevailing at a colliery, it must nevertheless be acknowledged that, taking all the circumstances into consideration, such a price in the holder for gas even of only 460 B.Th.U. is a verylow one.

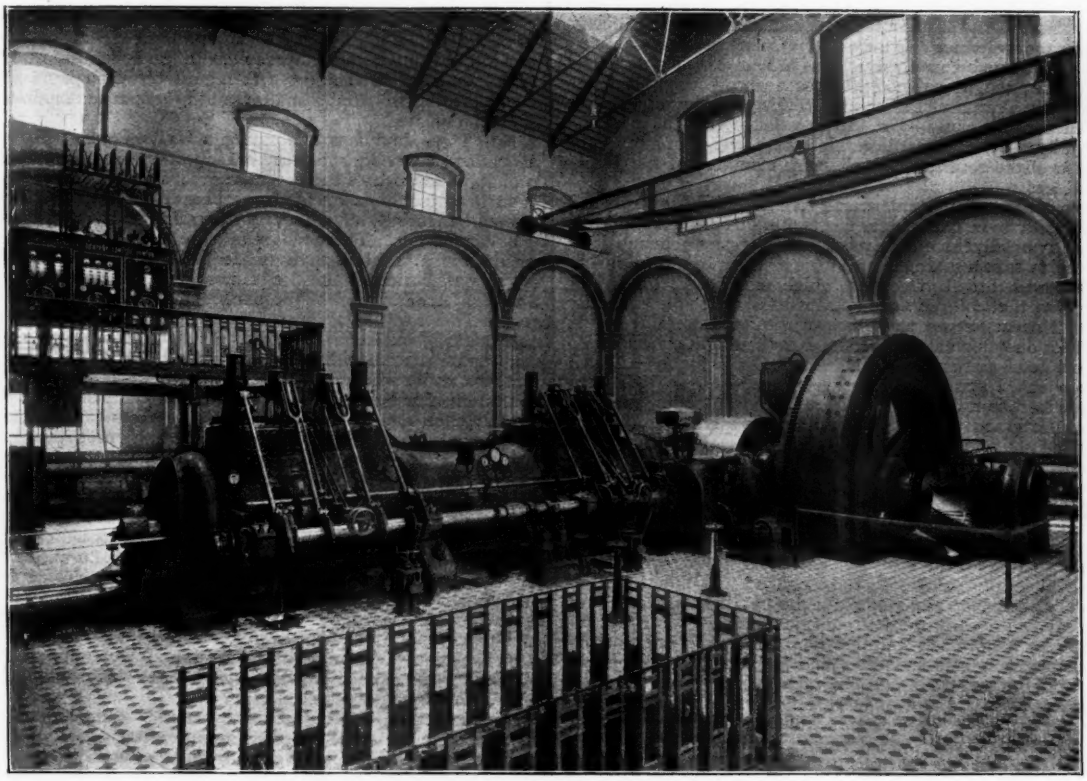


Fig. 3.—Gas-Engine of 1200 B.H.P.

Turning now to the utilization of the surplus gas, this, as previously stated, is partly employed for boiler firing, but chiefly for the production of power by means of large gas-engines. One of these is a two-cylinder engine of the Cockerill type, built by Messrs. Richardson, Westgarth, and Co., of Middlesbrough, of about 650 H.P., and is employed for driving the ventilating-fan. The second is a much larger engine, of 1200 B.H.P., directly coupled to an electric generator furnishing the supply of electrical power for the Company's collieries in the Rhymney Valley, which embraces at present 170 motors, some of which are of as much as 250 H.P.

Owing to the high percentage of hydrogen in the gas, difficulty was experienced in getting any of the large gas-engine makers to face the problems presented by the composition of the gas, and the necessity of very accurate governing for the purposes of the parallel running of the electric generators with others driven by steam-engines. Eventually, however, the task was undertaken by the Vereinigte Maschinfabrik Augsburg und Maschinenbaugesellschaft Nürnberg A.G., of Nürnberg, who erected the above-named engine, which has been working with complete success since February, 1907. This engine, an illustration of which is given in fig. 3, has two cylinders in tandem arrangement, 870 mm. (35 inches) in diameter and 1100 mm. (44 inches) stroke, working on the Otto cycle; and at 100 revolutions per minute it develops 1200 B.H.P. In addition to the cylinders themselves, the cylinder covers, pistons, piston-rods, and exhaust valves are all water-cooled, and the pistons are provided with rods and tail-rods fitted with cross-heads, so that the weight of the pistons is not taken by the cylinder. Ignition is effected electrically, and the engine is started by compressed air, pumped into a reservoir by means of a small electrically-driven air-compressor. The total weight of all the revolving parts, including the directly coupled 825 kilowatt generator, is 60 tons.

In consequence of the high percentage of hydrogen in the gas, only a moderate degree of compression can be employed—viz., between 6 and 7 atmospheres; and under these conditions pre-ignition is an exceedingly rare occurrence. The limitation of the compression, however, prevents the engine taking any considerable overload. During the twelve months it has been at work, the engine has given complete satisfaction. Certainly the impression made on a visitor to the engine-room by its running is a most favourable one; the smoothness and quietness of working being most noticeable, and the governing arrangements most efficient. The variation in speed is only about 0·3 per cent. Tests made of the actual working under the full load of 820 kilowatts at a speed of 100 revolutions per minute, with gas of 458 B.Th.U., showed that the engine used 21·3 cubic feet of gas per B.H.P. hour. Converting this, for comparison sake, into the equivalent quantity of gas of 600 B.Th.U., it corresponds to a consumption of 16·25 cubic feet of such gas per B.H.P. hour.

In consequence of the performance of this engine, a second has been ordered from the Nürnberg Company, and is now being erected. This is a twin-tandem four-cylinder engine, and it will develop 2400 B.H.P. at 100 revolutions per minute. The alternating current dynamo is arranged between the two halves of the engine; and the measurement and design of each of the two halves correspond, in all particulars, with the tandem engine described above.

ADDRESS TO JUNIORS BY MR. JAMES W. HELPS.

London and Southern District Junior Gas Association.

At the Annual General Meeting of the Association—which was held at the Cripplegate Institute last Friday evening, under the presidency of Mr. W. Upton—an interesting address was delivered to the members by Mr. J. W. HELPS, of Croydon.

The PRESIDENT having, on behalf of the Association, offered a hearty welcome to the lecturer,

Mr. HELPS said he regretted having been compelled, by an attack of influenza, to postpone the delivery of the address from last February, when it had been originally promised. He, however, heartily congratulated the Association on being possessed of officers who, at a moment's notice, could on such an occasion go round and secure someone to fill the breach; and he must also thank Mr. Webber for having come forward and "saved his face." He then proceeded as follows.

When some time ago your President asked me to address you, I gladly accepted his invitation, although at the same time I appreciated the difficulty of the task I was undertaking, knowing as I did how little time I should have for the preparation of such an address as would be worthy of your Association. Now that the time has arrived for me to fulfil my promise, this feeling is much intensified. But I have my consolation in the belief that you will not be over-critical, and will look upon what I have to say simply in the light of a friendly chat on matters of every-day happening intended to draw your attention to the importance of applying to our daily routine such methods of systematic observation as will not only add materially to the interest which we take in our work, but which will convert what may perhaps appear to us as possessing but little importance in the furtherance of the interests of our industry into a work of distinct value, forming, as it will, no inconsiderable link in the chain of knowledge which must be forged before anything approaching real success can be obtained.

I have read with much pleasure, as well as much instruction, the contributions to the literature of our profession by members of this and other societies of a similar nature, and have generally been struck with their high character and with the indications which they give of careful observation of facts and of that intelligent reasoning which has resulted in deducing from them such valuable information. I know from considerable experience as Secretary of a District Association, how difficult it is to secure papers for the annual meetings of sufficient calibre to render them worthy of presentation. This is, I am aware, a difficulty which

not only affects District Associations, but also the Parent Society. How is it accounted for? It may be that some members hesitate to lay their efforts before their fellows in fear of the strong light to which they will be subjected by those who discuss them, not forgetting the Technical Press; and to this possibly may have to be added another cause—viz., the knowledge that their quality will be judged by a standard certainly not lowered of late by the excellence of the contributions of many members of the Junior Associations.

I think another important reason for the difficulty to which I have alluded is to be found in the fact that engineers and managers of works, especially those of any size, are, in these strenuous days, compelled to take a more general view of their business, and to deal more with broad principles, which makes it less easy for them to give that minute attention to details which is generally considered necessary for the preparation of a successful paper. I do not for one moment mean to infer that general principles do not afford good matter for contributions; for probably on them have been based many of the most successful ones which have from time to time appeared. But I still think that the reason I give does partly account for the limitation of papers offered at our meetings.

If I am right, it may be worth while to consider how the point may best be met. I think every right-minded engineer will confess that in the preparation of any paper which he may have submitted, he has depended to no small extent for his details, and for the carrying out of his experiments, upon the work of his assistants. In the past, however, except in a few exceptional cases, assistance of a sufficiently technical and scientific character was seldom available; and even at the present time there are, I am sorry to say, many companies of considerable size controlled by directors who have yet to learn the importance of giving to their engineers and managers such qualified assistants as will enable them not only to carry out the necessary operations at their own works on a methodical and sound basis, but also bear their fair share in the gathering together and collating of such information as would be of service to the industry generally.

I cannot help thinking that this parochial spirit has in the past done more to stay progress by hindering the true appreciation of the value of the scientific side of our profession than anything else that can be mentioned. Unfortunately this same spirit has affected the commercial side of our business, and has rendered it a matter of the greatest difficulty to obtain for any venture, however promising of good results, such support and financial aid as will allow of its being given a satisfactory trial. Possibly the time will come when companies will recognize the fact—and recognize it in a practical way—that any effort made to prove the advantages of the proper use of gas, and to bring the best methods of obtaining such advantages before the public, must eventually reflect beneficially on their own undertakings, however remote they may be from the actual spot selected for the demonstration.

Happily, however, there is an increasing tendency to find room on gas-works for more technical assistants than were formerly deemed necessary; and I am glad to say that not only are such assistants as a rule well educated, but every opportunity is given them in our technical schools to continue their education, and to add to their attainments after they have fairly embarked on the wage-earning period of their lives. I feel sure that I am voicing the opinion of every engineer and manager, when I say that the greater the amount of information disseminated among the members of our profession, and the more opportunities they are given for interchange of ideas and inspecting and discussing methods at various works, the better for the industry at large.

Our business is not one which demands, except in very exceptional circumstances, that processes should be kept secret, or one in which the engineer need take steps to keep his works a close preserve. There exists, I am glad to say, a feeling of good fellowship which prompts an engineer to show to his colleagues—sometimes with an excusable feeling of pride—any process for which he may be partly or wholly responsible, and which may have been productive of good results; and though occasionally circumstances have arisen which indicate that such confidence has been misused or betrayed, I still trust that the day may be long distant when the feeling to which I have referred shall cease to exist. If what I have stated is correct, does it matter very much if the Senior Societies do fall short somewhat in the number of papers submitted descriptive of detailed processes, and if they have to confine themselves more particularly to contributions dealing with organization and general principles, so long as such shortcomings are compensated for in the way they have been, and probably will be to a far greater extent in the future, by the efforts of those who belong to such bodies as the one I have the privilege of addressing this evening? Such Societies are new; and before they were started the assistant had to be content—and probably to his credit was content—to see his work appearing as part and parcel of an important communication from the pen of his chief.

I do not wish to infer that the assistant had any right to complain. His work was under the guidance and direction of his chief, whose property, in a sense, it was; and so far as my memory serves me, the author of a paper has generally been ready to publicly acknowledge the share taken in its preparation by his assistants. But with the inauguration of Junior Associations, a fresh state of affairs has arisen. Assistants and others in subordinate positions join these Societies with the full permission, and with the best wishes, of their chiefs, who encourage them to give to their colleagues the benefit of any experience they may have gained in the working of any particular plant or process; being, I am sure, rightly impressed with the belief that, so long as information on any subject with regard to which knowledge is wanted is disseminated, it matters not by whom such information is communicated.

Now I am doubtless addressing a body of men whose daily avocations cover almost every branch of the gas industry; and probably the work of each is, as a rule, confined to some particular branch or department the working of which affects the whole system beneficially or otherwise according to the way in which it is carried out. There must therefore be details in connection with it which, if intelligently treated, will form a worthy subject for a contribution to the programme at some meeting of your Society. Are not most of you particularly well placed for intelligently observing the workings of your special branch, for recording observations, and for making trials of new processes, or variations from usual routine, either by permission of, or at the suggestion of, those under whom you may be working? It is only by concentration and by specializing in the first place that definite information on any particular method or process can be obtained. And though I do not intend to recommend any process or mental attitude which will result in a man so limiting his thoughts and vision as to exclude the consideration of the whole matter of which details form but a part, still I would strongly advocate such a system of training as will permit the worker to cultivate that power of concentration which will enable him at will to confine his attention to any particular difficulty or problem until he has thoroughly mastered it in spite of the obstacles with which he will probably be confronted; and when I say mastered, I do not mean him to be content simply with securing the result he has set out to obtain. This is in itself useful; but to be truly successful, he must have convinced himself that he thoroughly understands the reasons for the altered conditions and for the successful results that he has finally obtained.

For the reason I have previously stated—viz., the variety of your occupations—it is impossible for me to illustrate my meaning in such a way as will appeal directly to all of you. I trust, however, the principle implied in the example I propose to take will be possible of application to the work in which you may be severally engaged. Let me take my illustration from the retort-house, where the earliest steps are begun in the manufacture of coal gas. With the exception of minor details, the system of dealing with the gas between the retort and the foul-main is the same now as it was in the very earliest days of the industry. The ascension and dip pipes and the hydraulic main are almost identical; while the method of distilling the coal in horizontal retorts varies very little indeed from ancient practice. Now, would not an outsider be justified in assuming that, after such a lengthened experience of these methods, and considering the attention which has been paid to them by so many capable men, everything worth knowing about them had long ago been discovered, and that the mere fact that they are still continued should be sufficient proof that they are satisfactory, and practically devoid of difficulties? Can it be truthfully said that this is really the case?

Is there any manager, assistant, or works foreman who is unable to recall times of difficulty in the retort-house due to trouble with stopped pipes and thick tar in the hydraulic, the very recollection of which forms a sort of nightmare, and the recurrence of which he knows is not an improbable, much less an impossible, matter? Is it not strange that such a state of affairs is still possible? Strange though it may be, I fear we must admit its truth; and the reason in my mind is not far to seek. It is, I feel sure, a fact that too little attention has been paid to sustained methodical and scientific attempts to investigate and thoroughly understand the actual conditions which exist during the process of carbonization and during the early stages through which the resulting vapours and gases pass on their way to the hydraulic main. Had these investigations been successfully carried out, would such an occurrence as occasionally arises at my own works be possible, where, after a period of easy working without stopped pipes, with tar in the hydraulics so fluid that it runs away almost as freely as does the liquor, we are suddenly plunged into a turmoil of pipe-jumping and the not infrequent accompaniment of blocked hydraulics, and tar so clogged with free carbon that it is almost impossible to separate the water from it—a state of affairs responsible not only for much pecuniary loss, but for an amount of irritation among the workers, from the manager downwards, which could hardly be so successfully brought about in any other way? Nor must I forget the tar contractor, who is, I fear, called upon at times to deal with an amount of liquor in the tar sold to him which bears unfavourable comparison with that of ten or twelve years ago.

Have I not in this short sketch indicated sufficient scope for careful research and accurate observation to give useful employment to anyone whose duty brings him in contact with retort-house working for many a long day to come? Let me confess, in asking you to do what so many have failed to accomplish, I am setting you a very difficult task. May I, however, venture to give you what I believe to be the principal reason for the continued failure?

It is, I fear, unfortunately, but somewhat naturally, the case that when a difficulty has been overcome or an improved result obtained, the manager or assistant responsible for the result is satisfied with what has been done, and does not sufficiently concern himself with a careful review of the various steps which have

been taken in securing the position; nor does he attempt to make sure that he understands them to the extent of being able to revert to the original conditions, and, by repeating them, to bring about the improved results on any desired occasion. More often the investigator is satisfied with giving to himself or to his chief a general and plausible explanation which is certainly seldom capable of proof, and with which he himself is but partially satisfied. Some years ago, when using certain North Country coals, in regenerative settings, and with stoking machinery, I was able to produce an average of 10,600 cubic feet per ton. Latterly, under very similar conditions, I am able to improve on this result to the extent of about 10 per cent. I am ashamed to confess that I cannot explain to my entire satisfaction the exact circumstances responsible for the improvement. I can give you a general idea, and can detail certain changes which have been made, and which doubtless contributed to it; but I must acknowledge that the observations and experiments which were made at the time the changes were introduced, were not carried out and recorded with such accuracy and method as would enable me to say with anything like certainty what the actual effect of each of them was, and what share it bore in the final result. Now, I quite appreciate that the research necessary to meet the requirements I mention is not easily carried out; but I think that some of the papers read at the meetings of the Junior Associations of late prove that greater care is being taken in methods of observation, in classification of results, and in methodical deductions, which promise well for an early solution of many difficulties which at the present time so frequently upset the working of modern gas-works practice.

Let me give you an instance of the way in which insufficient observation of the "familiarity breeds contempt" type may result in the continuance of a faulty feature in an otherwise satisfactory system; and I do so with the knowledge that the narrative may not show either myself or my assistants in an entirely favourable light. I hold the opinion, however, that a confession of failure is at times likely to prove even more useful than a statement of success.

We adopted some years ago the Dillamore tower in connection with the removal of the tar from our hydraulic mains; and perhaps before going any further I had better give a short description of the process. The hydraulic main is subdivided so that each setting has a separate division for its tar and liquor, which are drawn off by pipes connecting up to a 6-inch tar main having a fall towards the tower. The overflow from this tower is so adjusted as to keep the liquor in the hydraulics at the required height; and I need hardly say how very important it is that all the sections should be kept uniformly level. As the tar forms, it passes away to the tower, to the bottom of which it drops. At intervals, a cock is opened, and the tar which has collected is allowed to run away to the wells. At the same time as this is done, by a system of levers, another cock is also opened, and the liquor admitted to the top of the tower, to make up for the loss of tar, and so maintain the level in the hydraulics. Now working in the way I have described, we found it difficult to get the tar to run away uniformly from the various sections of the hydraulic; the one nearest the tower losing its tar first, and so on, back to the furthest section, from which it was difficult to get the tar away at all without checking the flow from the other sections by means of regulating cocks.

Probably those of you who are acquainted with the system will have already noted the weak point in our working. I may say, however, that it was some considerable time before it dawned upon us where we were wrong. It will be easily seen that the fault lay in the point at which the liquor was admitted—viz., at the top of the tower; for if the liquor was to get to the hydraulics to make up for the loss of the tar, it must do so by struggling back against the outflowing tar, and thus hinder its free exit from the main. When we discovered our mistake, we connected the liquor pipes to the top of each hydraulic section; and by a similar set of levers, the liquor was admitted by the same action as opened the cock for drawing off the tar from the towers. The result was that the liquor flowing in at the hydraulic, instead of impeding the tar, actually assisted it; and since making the alteration, we experience far less trouble with thick tar in the hydraulic.

I mention this incident to show how important it is to carefully observe and follow throughout the whole course of its intended action every detail of a system in practical working. But the Dillamore tower, even if properly worked, simply secures the removal of the tar before it has time to settle and thicken. It does not in any way prevent the production of tar in such a form as will be responsible for trouble if not immediately withdrawn, nor does it do away with the consequent trouble due to the difficulty in separating the water from the tar. The real trouble is undoubtedly due to actions which take place during the distillation of the coal, and the subsequent passing of the gas and vapours through the ascension-pipe.

Probably most of you have read the very instructive lecture which Dr. Colman delivered before the Manchester Junior Association, and will remember that he described the changes that took place in the nature of the gases given off from the coal due to their being subjected to the high heat of the retort in their passage to the ascension-pipe. Now the difficulties to which I more particularly allude are due to these actions, which include the breaking-up of certain hydrocarbons in such a way as to produce free carbon, which, mingling with the condensed products in the ascension-pipe and in the hydraulic, cause the stoppages and pitching-up of the hydraulic with which we are unhappily too well acquainted.

Now the fact that at times when using one description of coal no such difficulties are experienced, yet when a change is made to another coal from the same district trouble arises, suggests that the principal reason for the difficulty lies in the fact that in the latter case the gas comes off more slowly at certain periods during the burning-off of the charge than in the other; and the slow travel of the small quantity of gas produced (especially, perhaps, towards the end of the charge) over the hot coke and in contact with the hot retort, is responsible for the excessive quantity of free carbon. Is it not possible that, under the varying temperatures which must exist at different times during the burning-off, and which must affect the temperature of the outgoing gases, changes in the condition of the products in the ascension-pipe must take place, and that these changes have no little share in the stoppages which occur? I know that Dr. Feld, who has given a vast amount of attention to this subject, holds this opinion, and has come to conclusions which, if confirmed, may materially alter the views which many now hold as to the proper treatment of the gas from the retort onwards. It is greatly to be hoped that Dr. Feld will soon be able to publish a full account of his researches on these points, and give further information as to the practical and financial results obtained by putting into practice the methods of treatment which he believes to be most suitable.

Personally, while agreeing with Dr. Colman on the subject of the vertical retort system, I think that with the improvements which have been made in stoking machinery we shall be able, even with our horizontal retorts, to obtain many of the advantages of that system, especially as regards the avoidance, to a large extent at any rate, of the troubles we are now considering. If I am right with regard to what I have said as to the reason for the trouble arising with certain classes of coal, it may yet be possible to change the working conditions at will, so as to avoid trouble. For instance, when using a coal which is apparently responsible for the formation of a large quantity of free carbon, it might be possible to considerably increase the weight of the charge, and thereby reduce the space between the top of the coal and the roof of the retort, and so lessen the time the poorer gases would be in contact with the heated surfaces.

Unfortunately, with the machinery generally in use, this increase beyond certain limits is impossible, because of the difficulty experienced in getting the rake over the top of the charge in order to withdraw the coke. But the introduction of the "discharger" bids fair to overcome this objection, and to allow of the pushing-out of a charge of any required size. I know of several works where a considerable increase in the size of the charges has enabled the engineer, not only to produce a greater quantity of gas per ton of coal, but also to do away with stopped ascension-pipes and thick tar troubles.

In saying this, I do not wish to infer that it is only in respect to the avoidance of these particular troubles that the vertical retort system has any advantages; for to judge from the detailed information given on the subject by Herr E. Körting in his recent valuable communication, it would seem that the vertical system has the advantage over horizontal retorts and stoking machinery, not only in respect to capital outlay, but also to a much greater extent in the matter of labour required. But even if the vertical system proves as successful as seems likely, some years must of necessity elapse before the whole of the existing horizontal retorts are entirely replaced by those constructed on the newer system; and in the meantime every attempt must be made to obtain the best possible results with the older form of setting.

I know I am addressing an audience which, as I said before, is composed of members who are called upon to deal with all branches of our business; and in the line I have taken I fear I shall have appealed to but a small proportion of those present. My object, however, has been to show, by taking a familiar example of routine practice which has been in constant use for so long a period, and which is yet far from perfect, that there still remain for those who are connected with our business great opportunities for devoting such care and attention to the observation of every-day conditions and to the carrying out of experimental research as will lead to more intimate knowledge of the principles involved in the various processes connected with our business, and which knowledge, when at our disposal, will doubtless lead to the solving of many problems which have long remained obscure, and the solution of which will not only add greatly to the welfare of our industry, but to the comfort of those engaged in it.

At the conclusion of the address, there was a hearty round of applause, and

The PRESIDENT remarked that they had had just what they might have expected from Mr. Helps—a very valuable address. From one point of view it was particularly interesting, because there was certainly one thing referred to which they could all attain to, as it was a matter of training—and that was the power of observation. This, he thought, was to-day the greatest of all points in their business, the changing aspect of which was seen everywhere. The ability to follow what these changes consisted of, and to what end they were trending, depended upon the power of observation. The question of the manufacture of gas was a most interesting one; the whole process was altering. From the comfortable practice of the old horizontals, they had seen many changes—inclines and verticals; and who could tell that the cycle might not come round again? If it did, it would depend

upon the observation of some intelligent men. Even in dealing with consumers, the man of observation was required; and so it was right through the whole business. As regarded other remarks of Mr. Helps, they, of course, realized that they were juniors—that they were the learners, though they hoped that later on they would be teaching others. Personally he was very glad to have Mr. Helps with them that evening, as he was present on a similar occasion last year, when the Association held their *conversazione*. He proposed a hearty vote of thanks to him for his address.

Mr. W. Grafton seconded the motion, and remarked that the address had been a treat in more ways than one.

Mr. W. J. Liberty supported the vote, and it was heartily accorded.

Mr. Helps, after thanking the members, said he must confess that his little address was written when he was ill in bed; and he had been so busy since that it was only a few days ago he had an opportunity of reading it through. He then felt more inclined to tear it up and write a fresh one than to deliver it as it stood. What he wished to emphasize was the need for the cultivation of the faculty of close observation. When visiting a technical school recently he saw a motto exposed "Eyes first; hands next; tongues last." This struck him as being a very forcible legend to place before youths who were learning. In one part of his address he had spoken of the time when perhaps he was working without a single stopped pipe, and that this was altered by a change of coal. He never had the matter more vividly brought to his notice than on this occasion. A special coal came in, supposed to be one of the best, from which he had obtained excellent results in past years; but somehow or other a change had come over the coal, and this consignment was of an extremely friable nature. He noticed also on analyzing it that it was almost entirely devoid of moisture. He found when using this coal that about two hours after it was put in, the ascension-pipes stopped up; and in a few hours practically every ascension-pipe in the retort-house was stopped. The moment they gave up this particular coal, and went back to another sort, the original favourable state of affairs returned. He was afraid that so far he had not discovered an entirely satisfactory reason for the trouble. When he went over last year to Germany to look into the Feld process to which he had referred, he had a most interesting discussion with Dr. Feld, who told him many things which he hardly liked to divulge. He could, however, tell them that he (Mr. Helps) did not think anybody really appreciated the importance of watching and finding out what occurs in the ascension-pipe itself. Most of them believed that, when they had got the gas out of the retort, nothing of importance was going to take place between the retort itself and the hydraulic main. But it was just this very little distance which he thought was responsible for half the troubles that they experienced. It was a most important point. The ascension-pipe was a subject to be studied; and if they could only find out what went on there, they would be benefiting the industry generally. He thanked them for their kind greeting, and congratulated them on the evident success that had attended the efforts of those responsible for the formation of the Association. He had noticed that many of the papers contributed to the Junior Societies showed that the work carried out by the members now was of a higher order than that which was performed formerly by some of those who were now seniors.

Previous to Mr. Helps giving his address, the members proceeded to the election of officers for the session 1908-9. The result was as follows:—

President.—Mr. W. J. Liberty.
Senior Vice-President.—Mr. H. Rothwell.
Junior Vice-President.—Mr. A. Barnett.
Council.—Messrs. W. Upton (*ex-officio* for two years), F. Ainsworth, S. A. Carpenter, J. R. Gale, J. Hewett, P. F. Scarth, P. J. Smithers, L. F. Tooth, and D. Winslow.
Auditor.—Mr. E. G. Merry.
Hon. Secretary.—Mr. J. G. Clark.

On the proposition of Mr. Liberty, seconded by Mr. Tooth, the following resolution was unanimously carried: "This general meeting of the London and Southern District Junior Gas Association desires to place on record its hearty appreciation of the services rendered by Mr. W. Upton to the Association during his presidency for the last two years, and hereby tenders to him its sincere thanks for the interest he has displayed, and the time and energy given, in all that pertains to the benefit of the members, and especially in his promotion of their educational welfare, and notes with gratification the increase of membership during his term of office. In thanking him, on his vacating the chair, the Association trusts he may be spared many years of useful service to the gas industry, with which he has been so long connected."

It was agreed that this resolution should be suitably inscribed, signed by the Secretary, framed, and presented to Mr. Upton.

GAS LIGHTING AT THE SCOTTISH NATIONAL EXHIBITION, EDINBURGH.

By W. R. Herring, M.Inst.C.E.

[*Photo. by the Scottish National Exhibition Studios.*

View of Buildings at the Scottish National Exhibition—Taken at 10.30 p.m., May 9, with One Minute's Exposure.

Gas lighting plays an important part in the illumination of the Scottish National Exhibition, which was opened on May 1 by H.R.H. Prince Arthur of Connaught; and it will no doubt be of some interest to briefly state what has been done to demonstrate the efficiency and economy of coal gas for both exterior and interior illumination for such and similar purposes. To simplify the description, the subject is subdivided into the following headings—viz., "Exterior Illumination" and "Interior Illumination."

Exterior Illumination.

The main entrance to the exhibition is approached by a bridge spanning a river. The bridge is lighted by means of eight "Vesta-Graetzin" inverted self-intensifying gas-lamps, with three burners and mantles in each, supplied by Messrs. Falk, Stadelmann, and Co., Limited. These lamps were found to give, when photometrically tested, their best results when regulated to a consumption of 10·6 cubic feet of gas per hour each at 30-10ths pressure, and gave a total of 396 candles per lamp, or 37·4 candles per foot of gas consumed, with a clear glass globe. The lamps are suspended within a harp-shaped attachment surmounted upon a dwarf column supported upon the pedestals of the entablature of the bridge; the centre of the light being 14 feet above the carriageway. The area of the roadway lighted is not great; measuring in all 3546 superficial feet. The total illumination given by the lamps is 3168 candles, or 0·89 candle per square foot of area illuminated, for a consumption of 84·8 cubic feet of gas, costing 2¾d. per hour and yielding 1132 candles per pennyworth of gas consumed. The statement of tests of these lamps [next page] conveys some interesting information.

The entrance gateway, offices, and turnstiles, &c., are lighted by means of incandescent gas-lamps furnished and fitted by Messrs. J. & W. B. Smith and Messrs. Moffatt's Limited. Each central

Vesta-Graetzin Three-Light Lamp (Clear Globe).

Pressure on Burner.	Height of Lamp from Floor.	Distance of Lamp from Photometer Disc.	Angle.	Foot Candles at Photometer Disc.	Consumption per Hour.	Candle Power.	Candle Power per Cubic Foot.
Tenths.	Ft. In.	Ft. In.			Cub. Ft.		
25	15 0	17 9	45°	1 17	9·8	368	37·44
,,	,,	,,	,,	1·19	10·2	374	36·70
,,	,,	,,	,,	1·21	10·2	382	37·40
,,	,,	,,	,,	1·13	15·9	357	22·50
30	15 0	17 9	,,	1·26	10·6	396	37·40
,,	,,	,,	,,	1·11	11·4	349	30·60
25	4 0	15 1	4°	1·17	10·2	266	26·00
,,	,,	16 2	3½°	1·11	15·9	289	18·20

Remarks: At 25-10ths the consumption was reduced to 8·8 cubic feet per hour; but no photometric test was taken, on account of the loud noise made by the lamp. Similar conditions prevailed at 30-10ths on reducing the consumption below 10·6 cubic feet per hour. The last two tests—viz., at angles of 4° and 3½°—are as near horizontal as possible without cutting off part of the light with the lamp shade.

archway is fitted with a Nero-Graetzin 5-light inverted lamp, supplied by Messrs. J. & W. B. Smith; some of these lamps being also in use in other parts of the exhibition not specifically mentioned. When subjected to photometrical investigation, they were found to give their best results when regulated to a consumption of 14·1 cubic feet at 30-10ths pressure, and gave a total of 580 candles per lamp, or 41·1 candles per cubic foot of gas consumed, with a clear glass globe. The maximum candle power obtained from these lamps was 607 candles, with a consumption of 15·25 feet at 25-10ths pressure; but the efficiency per foot is only 39·8 candles at this consumption.

Nero-Graetzin Five-Light Lamp (Clear Globe).

Pressure.	Height of Lamp from Floor.	Distance of Lamp from Photometer Disc.	Angle.	Foot Candles at Photometer Disc.	Consumption per Hour.	Candle Power.	Candle Power per Cubic Foot.
Tenths.	Ft. In.	Ft. In.			Cub. Ft.		
25	15 0	17 8	45°	1·75	13·90	543	39·0
,,	,,	,,	,,	1·81	14·30	567	39·6
,,	,,	,,	,,	1·94	15·25	607	39·8
30	,,	,,	,,	1·87	14·10	580	41·1
,,	,,	,,	,,	1·90	15·20	594	39·1
25	3 6	16 1	3°	1·56	15·25	404	26·5
30	3 5	16 0	,,	1·50	14·20	386	27·2

Remarks: At 30-10ths, with a less consumption than 14·1 cubic feet per hour, the light decreased, and no photometrical test was taken. The last two tests—viz., at an angle of 3°—were taken as nearly horizontal as possible without cutting off part of the light with the lamp shade.

The Stanley inverted lamps, supplied by Messrs. Moffat's Limited, are of their well-known type. They are fixed at the entrance gateways and offices, and also in the kitchen of the first-class restaurant, and gave when photometrically tested and the gas pressure regulated to 25-10ths at a consumption of 8·3 cubic feet per hour, 338 candles, or 40·7 candles per foot of gas consumed. The following data regarding these lamps will be interesting.

Stanley Three-Light Lamp.

Pressure.	Height of Lamp from Floor.	Distance of Lamp from Photometer Disc.	Angle.	Foot Candles at Photometer Disc.	Consumption per Hour.	Candle Power.	Candle Power per Cubic Foot.
Tenths.	Ft. In.	Ft. In.			Cub. Ft.		
25	15 0	17 2	45°	1·12	10·0	332	33·2
,,	,,	,,	,,	1·20	9·3	350	37 6
,,	15 1	17 4	,,	1·12	8·3	338	40·7
,,	15 2	17 5	,,	1 00	8·2	310	37·8
,,	15 2	17 5	,,	0·86	8·2	262	32·0

Remarks: The first three tests were made with a clear globe and reflecting shade; the fourth test with clear globe, without reflecting shade; and the last with opal globe without reflecting shade. The loss of light with the opal globe is therefore 15·5 per cent.

Immediately upon passing the entrance portico to the exhibition, one has access to the main avenue leading to the Grand Promenade. The lighting of these areas has been entrusted to the James Keith and Blackman Company, Limited, who have installed one of their well-known high-pressure plants. The engines and compressor plant are situated in a small building to the left of the entrance portico. The Company have introduced for this purpose, for the first time, their new single burner inverted lamp of a guaranteed candle power of 1500 candles. Along the avenue, placed alternately on either side, 24 single lamps are erected, spaced from 29 to 70 feet apart. The breadth of the avenue is 40 feet; and there are 21 3-cluster lamps surrounding the Grand Promenade, which measures 580 feet long by 300 feet wide.

It may be mentioned that the principal exhibition buildings are placed around the Grand Promenade; thus forming a quadrangle. There is a further number of 41 single-burner lamps on the same system lighting other avenues and areas within the exhibition grounds. The lamps are suspended from a swan-neck attachment secured to the top of the column. The mantle, it may be interesting to note, measures $3\frac{5}{8}$ inches long by $1\frac{1}{2}$ inches diameter. One of these lamps tested in the first instance yielded 1630-candle power for a consumption of 24·5 cubic feet of gas per hour, which is equal to 66·5 candles per cubic foot. As on this occasion, however, the mantle was not found to be suitable for the size and shape of the flame, and the test was purposely carried out in order to enable the makers to adjust both the nipple of the lamp and get a properly-shaped mantle for the particular purpose, further tests were made at a later date, when the lamps were delivered for the exhibition proper. These results are tabulated in the following statements, which show some striking results.

Photometrical Tests on Keith's New High-Pressure Inverted Lamp—One-Mantle Light. Mantle $3\frac{5}{8}$ inches long by $1\frac{1}{2}$ inches Diameter, Slight Bulb Shape.

The normal quality of the gas would be 20 to 21 candles when burned in a No. 2 "Metropolitan" argand burner, and the calorific power of the gas at Granton 648·3 gross and 598·9 net, and at the testing-station 560 net. The test was taken by a Simmance and Abady's street photometer, which had been previously verified by testing a given lamp simultaneously on a 100-inch bar photometer and the portable photometer in the same room and under like conditions.

Pressure.	Height of Lamp from Floor.	Distance of Lamp from Photometer Disc.	Angle.	Foot Candles at Photometer Disc.	Consumption per Hour.	Candle Power.	Candle Power per Cubic Foot.
Inches.	Ft. In.	Ft. In.			Cub. Ft.		
61	4 6	40 0	2½°	1·05	24·6	1683	68·4
61	16 0	42 4	20°	0·95	24·6	1705	69·3
61	20 0	29 9	37°	1·81	24·8	1609	64·9

Remarks: Clear globe. Slight leak in the meter, which did not affect the index when the burner was shut off, but which may have affected the consumption.

April 29, 1908.

Photometrical Tests on Keith's New High-Pressure Inverted Lamp—One-Mantle Light. Mantle $3\frac{5}{8}$ inches long by $1\frac{1}{2}$ inches Diameter, Slight Bulb Shape.

Pressure.	Height of Lamp from Floor.	Distance of Lamp from Photometer Disc.	Angle.	Foot Candles at Photometer Disc.	Consumption per Hour.	Candle Power	Candle Power per Cubic Foot.
Inches.	Ft. In.	Ft. In.			Cub. Ft.		
61	4 9	40 0	4°	1·04	22·9	1655	72·2
61	16 0	42 1	20°	0·95	22·9	1685	73·6
61	20 0	28 9	37°	1·90	22·9	1572	68·6

Remarks: Clear globe. A slight leakage in the pipe amounting to 0·09 foot per hour, which has been allowed for.

April 30, 1908.

The area of the avenue along which some 24 single lamps are placed measures 45,527 square feet; and the total candle power emitted is 40,440 candles. This is equal to an illumination of 0·88 candle per superficial foot of area dealt with. The 21 3-cluster lamps around the Grand Promenade are of an exactly similar type to those already described. The total area of the quadrangle is 174,000 square feet; and the total candle power, 106,155. This illumination is equal to 0·61 candle per square foot of area lighted, and yields 2230 candles per pennyworth of gas consumed.

BAND-STAND.

The band-stand in the centre of the quadrangle is illuminated by means of twelve Nero-Graetzin 2-light lamps supplied by Messrs. J. & W. B. Smith. Each lamp is controlled to work at 25-10ths pressure by a service governor, and when photometrically tested was found to give its best results when regulated to consume 6·2 cubic feet of gas, yielding 218 candles, or 35·2 candles per cubic foot of gas consumed, with a frosted globe. The following statement of tests conveys some interesting information. With all lamps burning, 74½ cubic feet of gas per hour is consumed, costing about 2½d., and giving 2616 candles, or 1066 candles per pennyworth of gas consumed.

Nero-Graetzin—Two-Light Lamp (Frosted Globe).

Pressure.	Height of Lamp from Floor.	Distance of Lamp from Photometer Disc.	Angle.	Foot Candles at Photometer Disc.	Consumption per Hour.	Candle Power.	Candle Power per Cubic Foot.
Tenths.	Ft. In.	Ft. In.			Cub. Ft.		
25	10 0	10 4	45°	1·43	5·4	153	28·3
,,	,,	,,	,,	2 04	6·2	218	35·2
,,	,,	,,	,,	2·04	7·7	218	28 3
30	,,	,,	,,	1·94	6·1	208	34·1
,,	,,	,,	,,	2·13	6·8	228	33·5
25	4 0	15 11	5°	0·62	6·2	156	25·2
,,	,,	,,	,,	0·60	7·6	151	19·9

Remarks: All the above tests were taken with a ground-glass globe. At 30-10ths, on reading the consumption below 6·1 there was a marked decrease of light, and therefore no photometrical test was taken. The last two tests—viz., at an angle of 5°—are as near horizontal as possible without cutting off part of the light with the lamp shade.

It may be interesting to note that Messrs. Rosie and M'Kelvie's automatic lighting and extinguishing device has been introduced experimentally into the band-stand installation. The device is one that is actuated by a change of pressure. The lighting and

extinguishing is brought about by a momentary reduction of pressure, and is capable of adjustment to a considerable extent. One leading feature of the arrangement is the means by which the bye-pass flame is extinguished during the period that the lamp is burning; this being accomplished in a very ingenious way. The apparatus is in process of being patented; and therefore a more definite description cannot at the moment be given.

Grounds around Old Hall.

The lighting of the grounds around the Old Mansion-House south of the main exhibition buildings is accomplished by means of ordinary lamp-posts fitted with swan-neck connections, to which are suspended 5-light inverted Pharos lamps, furnished by Messrs. W. Anderson and Co. (Edinburgh), Limited. They are supplied with gas from the ordinary town main at a pressure of 30-10ths to 35-10ths. There are 28 lamps in all. When photometrically tested, they gave their best results when regulated to 25-10ths pressure and a consumption of 15·4 cubic feet, yielding 560-candle power, or 36·3 candles per foot of gas consumed, with a clear-glass globe. It must, however, be pointed out that these lamps are still deficient in that perfection of method of regulating which applies to some of the other lamps referred to, and that the results vary when testing different lamps. This point is worthy of the attention of makers.

"Pharos" Five-Light Lamp (Clear Globe).

Pressure.	Height of Lamp from Floor.	Distance of Lamp from Photometer Disc.	Angle.	Foot Candles at Photometer Disc.	Consumption per Hour.	Candle Power.	Candle Power per Cubic Foot.
Tenths.	Ft. In.	Ft. In.			Cub. Ft.		
25	15 0	17 9	45°	1·60	14·7	502	34·1
,,	,,	,,	,,	1·78	15·4	560	36·3
,,	,,	,,	,,	1·86	16·3	586	35·9
,,	,,	,,	,,	2·10	18·5	658	35·5
,,	3 9	13 4	4	2·10	16·0	372	23·2

Remarks.—Tests taken with clear globe. The last test—viz., at an angle of 4°—is as near horizontal as possible without cutting off part of the light with the lamp shade. One of the mantles showed signs of sooting after about an hour's burning. There is no means of regulating the air supply.

Interior Lighting.

At the outset, gas lighting appeared to have a poor chance at the exhibition for any purpose. Fortunately, both for the authorities and also for the industry, wiser counsels prevailed; and a reasonably fair share of lighting has been allocated to the Gas Commissioners. Although at one time it had been definitely arranged that the whole of the interiors were to be electrically lighted, negotiations resulted in gas being adopted somewhat largely. It was, however, only on the basis of competitive estimating. And these remarks apply to the whole of the succeeding lighting installations, for each of which competitive estimates were submitted by both the Gas Commissioners and the Electrical Contractors. The cheaper estimates were for gas; the estimates in all cases being based on candle power and cost per hour for illumination as well as equipment.

Fine Art Section.

The principal feature of the interior lighting is the illumination of the Fine Art Section. This consists of nine galleries, which the Gas Commissioners took under their especial care. The lamp selected for the lighting of these galleries is the 3-light "Empire" inverted lamp of Messrs. J. & W. B. Smith, fitted with frosted globes, and arranged as follows: In each gallery a double line of pipes is laid upon the roof structure; each line being placed 8 ft. 6 in. from the wall upon which the pictures are hung. Depending from this pipe, lamps are suspended 11 feet apart. This method is applied to all the nine galleries, with the addition that in the central gallery three further lamps are suspended, as this is of much higher pitch, and is intended for statuary as well as pictures. The double line of lamps in each gallery is shielded on the outer side with a curved-shaped screen, so as to prevent the light from one side of the room reflecting in the pictures on the opposite side. The central gallery, in addition to the "Empire" lamps, is fitted in the centre with a Thermopile Lucas lamp, which has been kindly lent by Messrs. Moffat's Limited, for the purpose. This lamp has already been fully described in the "Journal." Like others, it was submitted to photometrical tests, and was found to give 1814-candle power, burning gas at the rate of 40 cubic feet per hour, and 45·3 candles per cubic foot with a clear glass globe. The lamp is upright in form, with a single mantle, measuring about 6 inches by 1½ inches. The following is a note of the tests taken upon this lamp.

Lucas Thermopile One-Light Lamp (Clear Globe).

Pressure.	Height of Lamp from Floor.	Distance of Lamp from Photometer Disc.	Angle.	Foot Candles at Photometer Disc.	Consumption per Hour.	Candle Power.	Candle Power per Cubic Foot.
Tenths.	Ft. In.	Ft. In.			Cub. Ft.		
25	5 1	33 0	4°	1·66	40·0	1814	45·3
,,	,,	,,	,,	1·33	35·0	1450	41·4
,,	,,	,,	,,	1·05	30·0	1145	38·1
,,	15 0	29 7	25°	1·63	35·0	1426	40·7
,,	20 0	24 6	45°	1·94	35·0	1168	33·3

Remarks: Tests taken with clear globe. This burner makes a whirring noise.

On either side of the Thermopile lamp, a 5-light Pharos inverted lamp is fitted, supplied by Messrs. Anderson, and similar in every way to those erected by the firm in the gardens. The lighting and extinguishing of the lamps in the Art Section is under central control. Each lamp is fitted with one of Messrs. Alder and Mackay's automatic distance lighters. This device is actuated, both for lighting and extinguishing, by momentarily raising the pressure, or, so to speak, sending forward a pressure wave of from 8-10ths to 10-10ths in excess of the normal. The gas supply is controlled by means of a Peebles governor; and the lamps are adjusted to give their highest efficiency at 25-10ths pressure—the pressure in the district mains ranging from 32-10ths to 35-10ths. A bye-pass is introduced between the inlet and the outlet of the Peebles governor controlling the whole building; and the lighting and extinguishing of the entire installation is accomplished by opening the bye-pass stopcock for a period of one to two minutes, and then closing it again. The extinguishing is brought about by an exactly similar operation.

This system of lighting and extinguishing has been found to answer admirably. It is peculiarly well adapted to installations where control is desirable, or can be established, from one or more centralized positions, and the pressure-wave impulse made to reach all points either from a station governor or from a localized governor or small gasholder.

The "Empire" lamps, when photometrically tested, gave their best results when regulated at 25-10ths pressure to pass 7·75 cubic feet of gas per hour, yielding 355 candles, or 45·8 candles per foot of gas consumed, with a clear-glass globe. The following are the results of tests on this burner:—

"Empire" Three-Light Lamp.

Pressure.	Height of Lamp from Floor.	Distance of Lamp from Photometer Disc.	Angle.	Foot Candles at Photometer Disc.	Consumption Per Hour.	Candle Power.	Candle Power Per Cubic Foot.
Tenths.	Ft. In.	Ft. In.			Cub. Ft		
25	15 0	17 6	45°	1·16	7·75	355	45·8
,,	,,	,,	,,	0·96	7·10	294	41·4
,,	,,	,,	,,	0·98	7·75	300	38·7

Remarks: With the gas-regulator fully open, the consumption was 7·75 feet, so no test with a higher consumption could be taken. The first two tests were taken with a clear globe; the last test being taken with a ground-glass globe, causing a loss of light equal to 15·5 per cent.

Regret may be here expressed that circumstances prevented our testing all of the lamps with clear-glass shades. Attention may, however, be directed to the paragraph beneath the statement of tests of the "Empire" lamps, where it is brought out that the loss of light, by photometrical test, consequent upon using a frosted globe instead of a clear glass amounted to 15½ per cent. As a matter of fact, I am of opinion that the frosted or satin finish globe is by far the most satisfactory for interior lighting, and that, while there is an apparent loss photometrically observed, it is a question whether the diffusion and more equal distribution does not more than compensate for the apparent loss of light. The softness of the light and the slightly yellow tone resulting from the use of ground glass is much more pleasing, and, on the whole, better appreciated by the public.

The floor area of the galleries lighted (taking one gallery as an example) is 2640 square feet. There are sixteen of the 3-light "Empire" lamps fitted in each, giving a total illuminating power of 4800 candles, with frosted globes, which is equal to 1·8 candles per square foot of floor area illuminated. The total illumination in the whole of the galleries works out at 47,934 candles, with frosted globes, and the consumption of gas at 1233 cubic feet per hour. This, at 2s. 9d. per 1000 cubic feet, equals 3s. 4½d. per hour, or equal to nearly 1178 candles per pennyworth of gas consumed, or, by using clear glass, about 1400 candles per pennyworth of gas consumed could have been obtained.

Prince's Restaurant and Welcome Club.

The Prince's Restaurant and the Welcome Club, consisting of reception room, dining hall, smoking and retiring rooms, and verandah, are also lighted by gas at low pressure, controlled by means of a Peebles governor to 25-10ths pressure at the outlet; the lamps employed being adjusted to give their maximum efficiency at this pressure. In this building, Messrs. J. & W. B. Smith's 2-light and 3-light "Empire" lamps, and their single burner "Nulite" lamp are installed. Here the lamps are fitted in pairs and actuated by means of pneumatic distance lighters, so that they may be switched on and off at will.

The tests of some of the lamps installed have already been referred to; but the following statement relating to the "Nulite" burner contains a good deal of information. This lamp, when photometrically tested, was found to give its best results when the gas was regulated to a consumption of 3·03 cubic feet per hour at 30-10ths pressure, yielding 87 candles with a clear glass globe, or 28·71 candles per foot of gas consumed. It may be remarked that this lamp does not contain the regenerative or pre-air-heating device which most of the other lamps already dealt with embody. It does, however, ensure a fresh or unvitiated air supply by a bunsen tube. But the results are not so good as where the air supply is not only unvitiated, but preheated, in its access to the mixing-chamber; and, furthermore, it is a lamp that requires greater pressure for its highest efficiency. The area of the principal rooms lighted is about 5578 square feet;

and a total light of 3128 candles is provided. This is equal to 0·56 candle per square foot of area. The gas consumption per hour amounts to 97 cubic feet, which, at 2s. 9d. per 1000 cubic feet, works out at about 3¼d. per hour, or 977 candles per pennyworth of gas consumed.

"Nulite" One-Light Lamp (Clear Globe.)

Pressure.	Consumption.	Candle Power.	Candle Power per Foot.	Remarks.
Tenths.	Cubic Feet.			
15	2·56	67·00	26·17	
,,	2·46	67·00	27·23	
,,	2·35	61·50	26·17	
,,	2·68	70·00	26·12	
,,	3·19	65·00	20·38	Regulator fully open, special test at 3½ feet consumption.
20	3·06	79·00	25·82	
,,	2·85	79·00	27·72	
,,	2·69	74·00	27·51	
,,	2·50	66·00	26·40	
,,	3·54	74·00	20·90	Special test at 3½ feet consumption.
25	2·80	74·00	27·14	
,,	2·96	81·00	27·37	
,,	3·15	84·00	26·66	
,,	3·59	81·00	22·56	Special test at 3½ feet consumption.
30	3·16	88·00	27·85	
,,	3·03	87·00	28·71	
,,	2·94	82·00	27·89	
,,	3·53	90·00	25·49	Special test at 3½ feet consumption.
35	3·12	88·00	28·20	
,,	2·96	84·00	28·38	
,,	2·86	77·00	26·92	
,,	3·54	92·00	26·00	Special test at 3½ feet consumption.
15	3·54	78·00	22·03	
20	4·00	76·00	19·00	
25	4·02	80·00	19·90	Regulator fully open.
30	4·03	78·00	19·35	
35	4·04	83·00	20·54	

Remarks: This lamp is in appearance similar to the Graetzin; but, unlike the latter, it has no means of regulating the air supply. The gas-regulating nipple is not placed immediately over the centre of the lamp, as is usual, but is at the side; the gas being conducted over the "crown" of the lamp, down the side, and thence to the burner. The lamp is fitted with a chimney contained within the globe, as in the Graetzin.

General Dining Room and Restaurant.

The above restaurant, &c., situated to the south of the Industrial Hall, consists of a large dining hall, side wings, kitchen, service rooms, &c. This establishment is lighted by "Pharos" lamps supplied by Messrs. W. Anderson and Co. (Edinburgh), similar to those already referred to. The dining hall is lighted along the centre by means of four 5-light "Pharos" lamps, and along the two sides by 12 1-light "Pharos" lamps—the latter actuated by pneumatic switches. The total area of the hall is 4620 square feet, and the total candle power 3752 candles; giving an illumination of 0·81 candle per square foot of area. The gas consumption per hour for this section is 104 cubic feet, costing under 3⅜d. per hour, or 1093 candles per pennyworth of gas consumed. The single-burner "Pharos" lamp gives a high efficiency, but considerable variation on testing different burners. This arises primarily from the want of means of adjustment in the inner chamber where the gas and air meet. The following tests, however, of this particular lamp, when carefully adjusted, will show that it is of a promising character.

"Pharos" One-Light Lamp.

Pressure.	Height of Lamp from Floor.	Distance of Lamp from Photometer Disc.	Angle.	Foot Candles at Photometer Disc.	Consumption per Hour.	Candle Power.	Candle Power per Cubic Foot.
Tenths.	Ft. In.	Ft. In.			Cub. Ft.		
30	..	7 6	Horizontal	2·25	3·52	126	35·7
30	11 1	10 0½	45°	..	3·52	125	35·5

Remarks: These tests were taken with white porcelain cone in position. The lamp will not burn without this cone. The make of these lamps is not yet quite satisfactory, as the means of adjustment are not so easy as will be necessary to ensure the lamp the success that it deserves on the market, as in testing other lamps of the same class considerable variations are discovered in the quality of the mixture at the burner. The makers will do well to give these points their serious attention.

Industrial Hall Restaurant and Bar.

The above restaurant and bar, situated on either side of the main entrance to the industrial hall, are also lighted by incandescent gas on the low-pressure system, controlled to a pressure of 25-10ths by a Peebles governor. These lamps are of the "Nulite" pattern supplied by Messrs. J. & W. B. Smith. The total area of the restaurant amounts to 5050 square feet; and the total candle power is 2523. This gives an illumination of 0·50 candle per square foot of area, and a gas consumption of 88 cubic feet per hour, or less than 3d. per hour, or 870 candles per pennyworth of gas consumed. There are other minor sections of the exhibition where gas has also been installed, as well as to a number of the stall holders. They are mostly, however, fitted with lamps of the classes already dealt with, and need not be further referred to.

Saughton Hall.

Saughton Hall, an old mansion house, which forms part of the exhibition, is used as an administrative block and for exhibits of the artisan section, wherein specimens of handicraft of all trades, and the work done by the Technical Schools of Scotland, are exhibited in various rooms, as well as a section in connection with the Japanese Education Department. This hall was previously lighted by coal gas in the old-fashioned manner, but has been refitted throughout for lighting by means of incandescent burners of the inverted type—viz., two and three light "Empire" lamps and single-burner lamps supplied by Messrs. J. & W. B. Smith. Altogether some 94 lamps have been fitted in the various rooms, yielding 12,427 candles of illumination for a consumption of 323 cubic feet of gas; or, at 2s. 9d. per 1000 cubic feet, costing a little more than 10½d. per hour for the entire illumination of the building. This is equal to 1170 candles of illumination per pennyworth of gas consumed. Taking one of the principal rooms as an illustration, the area lighted is 1122 square feet, and the candle power 1370 candles, which is equal to 1·22 candles per square foot of area lighted.

Memoranda.

The preceding statements of tests need a few words of explanation in order that a true value may be put upon the results obtained. In the first place, the gas used would read 20 to 21 candle gas when tested on a No. 2 argand burner, and would have a calorific value of 560 net. The tests were taken in a large workshop; and the lamps to be tested were screened on three sides by a large black-painted framed screen, which completely cut off light rays from the walls of the building (which were by no means white) and the roof, which was black. There might be some slight reflection from the floor, but no more than would result from the ordinary ground surface where the lamps are normally installed. The apparatus employed was one of Simmance and Abady's street photometers adjusted and verified by testing a known lamp simultaneously on a 100-inch bar photometer and also on the street photometer situated in the same room at the same time.

The general scheme of lighting was devised by Mr. A. C. Freeman, C.E., the Chief Engineer to the Exhibition Committee. In planning it, he has provided for an ample flood of light, both as regards electricity and gas; believing that brilliant lighting is a source of attraction to the public, and adds a charm and fascination for the purposes in view. The lighting generally was placed in charge of the Machinery and Lighting Committee, of which Mr. James T. R. Wilson, the Convener of the Lighting Committee of the Edinburgh Corporation (who, it will be remembered, has done so much to bring Edinburgh into the front rank so far as its street lighting is concerned), is Chairman, and the following gentlemen members: Professor Beare, Professor Barr (Glasgow), Mr. Douglas, Mr. Alexander Gracie (Govan), Mr. C. N. Kemp, B.Sc., Mr. W. H. Massie, Mr. M'Michael, Mr. Newington (City Electrical Engineer), Mr. Hugh Reid (Glasgow), Mr. Simon Slater, Mr. George A. Scott, Professor Stanfield, Mr. James Thomson, C.E., Mr. W. B. Walker, Councillor J. T. R. Wilson (Convener), and Mr. W. R. Herring. Upon an official inspection of the lighting the day previous to the opening of the exhibition, all expressed their admiration of what had been accomplished.

The following table, giving the candles per square foot of area illuminated, and the number of candles per pennyworth of gas consumed, at 2s. 9d. per 1000 cubic feet, is rather interesting when taken comparatively.

Statement Giving the Degree of Illumination in Candles per Square Foot of Area Dealt with, and the Number of Candles of Illumination per Pennyworth of Gas Consumed.

Area Lighted.	Candles per Square Foot.	Candles per Pennyworth of Gas.	
Entrance Bridge . . .	0·89	1132	Clear glass.
Royal Avenue	0·88	2230	,,
Grand Promenade . . .	0·61	2230	,,
Fine Art Gallery . . .	1·95	1178	Frosted glass.
		1400	Clear glass.
Industrial Hall Restaurant	0·50	870	,,
Prince's Restaurant . .	0·56	977	,,
General Dining-Room . .	0·81	1093	,,

It will be observed that the principal restaurants are allocated half-a-candle per superficial foot of floor area dealt with; and it may be mentioned that this is an ample amount of light in such places, and in dwelling houses and offices. It is, however, a little remarkable to find the whole of the exterior illuminated with a greater degree of light than the interiors—excepting, of course, in this instance, the Art Galleries. I have found from experience that the half-candle of illumination per superficial foot of area covered in an ordinary sized room is ample, lighted from the centre. The inverted lamp invariably gives its best results at an angle of at or about 45 degrees. Taking an ordinary room (say) 18 feet square, centrally lighted, the height at which the fitting would be placed would throw the greatest degree of light on the floor at the skirtings, and ensures the most perfect distribution and illumination. The cost per 1000 candles of illumination (also referred to in the same table) is of interest, and is a most striking instance of the enormous advance that has been made from the days when three candles per foot of gas consumed burned in the best type of then known burner—viz., the "Metropolitan" argand—and which is still the standard by which coal gas illumination is officially measured.

WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.

General Meeting at Cardiff.

As was explained by the President, Mr. Edward Jones, at the meeting in September, he, having moved from Pontypridd to Burslem, was unfortunately "without a house in the area of the Institution" to which to invite the members; and therefore it was arranged that the general meeting which took place last Wednesday should be held in Cardiff. The choice proved a wise one, for the gathering was most successful in every way. For this, great thanks were due to the Cardiff Gas Company, who extended the warmest of welcomes to their guests—placing their offices in Bute Terrace at the disposal of the Institution for the business meeting, then entertaining them at luncheon, and finally arranging a visit to the Grangetown works, from which the city is supplied with gas. But the authors of the two papers which were discussed must also not be forgotten in this connection. The fact that there is in the streets of Cardiff a great deal of electric lighting (out of which the Corporation, it seems, do not make any profit) does not disturb the Gas Company, merely to enter whose extremely handsome offices (designed by their Engineer, Mr. Henry Morley) gives one that feeling of security which is so usually—and so justifiably—associated with gas undertakings. The room in which the meeting took place was the drawing-office; and it proved to be admirably suited for the purpose, there being ample accommodation for the very good attendance of members, over which Mr. EDWARD JONES presided.

A WELCOME TO THE CITY.

Before a start was made with the business portion of the proceedings,

Mr. GEORGE CLARRY, the Secretary of the Cardiff Gas Company, said that it was his pleasing duty, on behalf of the Company, in the absence of the Chairman and Directors, to offer the Institution a very hearty welcome. There was some interesting business to carry through at the meeting; and therefore he would not stand between the members and their work, especially as he was in hopes that the Chairman and Directors would shortly be present. He trusted the meeting would prove a pleasant one.

The PRESIDENT remarked that he was pleased to see so many present. There was a good programme before them, which he felt sure would be productive both of instruction and pleasure.

MINUTES OF LAST MEETING—REPORT AND ACCOUNTS.

The HON. SECRETARY (Mr. Octavius Thomas, of Pentre), then read the minutes of the meeting which was held at Shrewsbury last September, and they were confirmed. He also read the report of the Council and the accounts. These showed that there had been a further increase in membership during the past twelve months, and that at the end of the year there was a substantial balance in the bank.

LETTERS OF REGRET.

The HON. SECRETARY read letters of regret at inability to accept the invitation to be present at the meeting from the President of the Institution of Gas Engineers (Mr. W. Doig Gibb) and the Presidents of the District Associations.

ELECTION OF OFFICE-BEARERS.

The following officers were next elected for the ensuing year:—

President.—Mr. Thomas Acland, of Llanelly.
Vice-President.—Mr. J. H. Canning, of Newport.
Members of Council.—Mr. John Parry, of Cardiff, Mr. E. H. Swain, of Pontypridd, and Mr. H. D. Madden, of Cardiff—one in place of Mr. J. H. Canning.
Hon. Treasurer.—Mr. Henry Morley, of Cardiff.
Hon. Secretary.—Mr. Octavius Thomas, of Pentre.
Hon. Auditors.—Mr. S. J. Acland, of Blaina, and Mr. J. M. Small, of Merthyr Vale.

NEW MEMBERS.

The following new members were then elected: Mr. R. G. S. Browning, Assistant Manager of the Neath Gas-Works; and Mr. T. E. Franklin, Manager of the Barry Gas-Works.

DATE OF THE SEPTEMBER MEETING.

The PRESIDENT, in accordance with notice of motion standing in his name, proposed—"That the meetings of the Institution shall be held on the first Wednesday in May and the last Wednesday in September." He pointed out that this meant altering the date of the September meeting, as fixed by Rule 8, from the first Wednesday in the month to the last. The Council, at the Shrewsbury meeting, pretty well threshed the question out, and found the present date was so near the summer holidays as to make it inconvenient for many to attend. It was thought that by putting the meeting off a little the attendances would be better, and the interests of the Institution would be in every way enhanced.

Mr. A. H. BROOKMAN (Tenby) seconded the motion; and it was carried unanimously.

READING OF PAPERS.

Mr. J. H. CANNING (Newport) then read his paper entitled "Some Notes on the New Electric Lamps," which was submitted at the Shrewsbury meeting, but for the consideration of which there was not then sufficient time available. The paper was published in the "JOURNAL" for Sept. 10 last (p. 697); and a report of Wednesday's discussion will be found on p. 364 of this issue.

Subsequently a paper was read (and afterwards discussed) by Mr. A. J. Ward, the Manager of the Cardiff Railway Company's Gas-Works, on "High-Pressure Incandescent Lighting at the Queen Alexandra Dock, Cardiff." This paper, together with a report of the discussion to which it gave rise, appears on p. 366.

THANKS TO THE AUTHORS.

Mr. R. A. BROWNING (Neath) said it would ill become them to close the meeting without passing a hearty vote of thanks to the authors of the papers. They were both most valuable and practical contributions; and they had been discussed in a thorough manner, which reflected great credit on the Institution.

Mr. BROOKMAN, in seconding the proposal, remarked that he fully supported Mr. Browning in what he had said.

The vote was carried with acclamation.

PLACE OF NEXT MEETING.

Mr. THOMAS ACLAND said it afforded him the greatest pleasure to invite the members of the Institution to the town of Llanelly for their September meeting; and he need hardly tell them that it would be a further pleasure on his part, and on the part of his Directors, to make the members as comfortable as possible on the occasion of their visit.

The invitation was cordially accepted.

ACKNOWLEDGMENTS TO THE CARDIFF GAS COMPANY.

The PRESIDENT remarked that there was one other pleasant little duty he had to perform before they rose, and that was to propose that the best thanks of the Institution be given to the Chairman and Directors of the Cardiff Gas Company for their kindness in allowing the Institution to assemble on their premises. He was sure that it had not been the privilege of many Associations to meet in such comfortable quarters as they had had that day.

Mr. ACLAND seconded the proposition, and said it was through such kindness as this in lending a helping hand, that Gas Institutions like theirs obtained the assistance which was necessary for their successful working. The members were greatly indebted to the Company for receiving them as they were doing that day.

The vote was carried with applause.

THE LUNCHEON.

At the invitation of the Chairman (Mr. Charles H. Williams) and Directors of the Cardiff Gas Company, the members were, after the meeting, most hospitably entertained at luncheon in the Board-room. Mr. Williams occupied the chair; and Dr. Taylor, the Deputy-Chairman, and Colonel Fisher, a Managing Director of the Company, were also present. After the Loyal Toast had been honoured,

Mr. WILLIAMS proposed "Success to the Wales and Monmouthshire District Institution of Gas Engineers and Managers." He said he had heard that some of the best gas engineers in the world were present that day; and he regretted he was unable to attend the meeting to hear what they had to say. The Cardiff Gas Company would always be very pleased to receive them there. He trusted they would enjoy their visit to the Grangetown works that afternoon; he confidently believed they would. He coupled with the toast the name of the President.

The PRESIDENT, in responding, heartily thanked the Chairman and Directors, on behalf of the Institution, for their hospitality. He had not yet inspected the Grangetown works; but if they were in keeping with what they had already seen, he quite agreed with the Chairman that they had some of the best engineers in the world with them that day. During his stay in South Wales he had on several occasions come in somewhat close touch with the Cardiff Gas Company; and he had always been struck by the unostentatious way in which they went about their work, and by their friendly relations with the neighbouring authorities. The prosperity of the Company had no doubt been the envy, not only of South Wales people, but of others; and it was owing to the good engineering discipline which had been displayed from the Company's early days, and was being continued by the Institution's Treasurer, Mr. Henry Morley. With regard to the Institution, it was getting stronger as time went on; and the advantages that were indicated at its inception were being realized more and more every day. The gas industry never required better looking after than it did now; and it was only by moving among one another, picking as it were each other's brains, that they would ever be able to rise to the importance which their profession really justified. In England there were Associations in all parts of the land; and by means of these, it was possible to pass on knowledge one from another. In Wales, the works were far apart; and the coal was the best in the world for steam purposes, and perhaps the worst in the world (Hear, hear), or very close to it, for gas making.

They heard of high yields of 11,500 and 12,000 cubic feet per ton; but they were themselves very satisfied—or at least he was—with 10,500 feet. In conclusion, he proposed the health of the Chairman and Directors, and thanked them for their kindness.

The toast was drunk with musical honours, and Mr. WILLIAMS briefly responded.

Mr. T. CANNING proposed the healths of Mr. Morley and Mr. Clarry, and said the two gentlemen named were well worthy of the confidence the Company reposed in them. The success of the Institution, in the formation of which he took some share, was a matter of great pride to him; and he was pleased at the noble manner they had been received by the Gas Company.

Mr. MORLEY and Mr. CLARRY suitably acknowledged the toast.

VISIT TO THE GRANGETOWN GAS-WORKS.

The visitors were, at the conclusion of the luncheon, conveyed in special cars which were in waiting at the entrance of the offices, to the Grangetown works of the Company, over which they were shown by Mr. Henry Morley, the Engineer, and Mr. H. D. Madden, the Station Manager, and his other assistants. The works were described and illustrated in the "JOURNAL" as recently as last October (p. 160); and what was then stated requires but little supplementing now. It may, however, be remarked that, in addition to the completed work therein referred to, the members were fortunate in being able to see some still further extensions in progress.

The retort-house in which the West machinery is at present operating is now equal to an output of 4½ million cubic feet of gas per day; but it has been arranged so that there is room for a further extension of it. When ultimately seven more beds of retorts have been put in, the gable will be erected, and the house will be in a finished state. It is a structure admirable in every way for the purpose for which it is used; and the visitors were loud in their praise of it. Mr. Morley had arranged the charges so that the party might see the machinery in operation, and appreciate the smoothness with which it works. All the coal that is now being used is Yorkshire; and though when starting with this last winter Mr. Morley fancied he might possibly experience some little trouble, he has had no difficulty at all. He is working six-hour charges of 3¾ cwt., with 4 cwt. in the middle retorts. With reference to the saving effected by the machinery, it may be pointed out that, while under the old conditions the make per man was a little over 20,000 cubic feet, there is at the present time, under the new order of things, a make of over 50,000 feet per man. A good deal of the success of this house Mr. Morley no doubt rightly attributes to the fact that he is himself a practical man. At present the coal-trucks are discharged by hand labour; but it is intended to substitute tipping machinery, so that the gas may be made entirely without hand labour, as well as the coke delivered into waggons in a similar manner. The air compressing plant is in duplicate—one working, and one off; and the foundations are ready for the installation of a third compressor when the retort-house is extended to its full capacity.

In going over the works, the fact is borne in upon one that Mr. Morley is a great believer in having his new machinery in duplicate. The engine working the coke conveyor is the only one that has not been duplicated; but, of course, this is not running continuously, so that there is not the same need for it here. One of the excellent points to be noted is that all the mains and connections (which are 24-inch, and 30-inch on the outlet of the gasholders) are wherever possible exposed, so as to be easily accessible in case of necessity. All through the works the spick and span appearance of the plant is an outstanding feature.

Oxide only is used for purification now; and no trouble has been experienced in consequence of the change, which was effected gradually. Mr. Morley has recently fitted some of Messrs. C. & W. Walker's hurdle grids in his purifiers, thereby securing increased purifying capacity; and he has found them very satisfactory. There are six overhead purifiers, 40 ft. by 24 ft.; and these are filled, by means of a band conveyor and a shoot which can be shifted to any purifier, with oxide taken from the ground level. The spent oxide is discharged from the bottom of the boxes on to the floor below. There are also twelve ground-floor purifiers—six 24 feet square, and six 38 ft. by 16 ft. In order to overcome the naphthalene difficulty, experiments are being carried out in using benzolized tar; and it is found that by this means a great deal of the naphthalene is removed from the gas, and with the plant in use it has been noticed that the tower scrubbers keep themselves clear. Benzol is also introduced at the inlet or the outlet of the gasholder.

Now with regard to the work which Mr. Morley has at the present time on hand and in near prospect. Men are engaged erecting a building which will be capable of containing plant to produce 4 million cubic feet of carburetted water gas per day; and two sets of 1 million cubic feet each, by Messrs. S. Cutler and Sons, are to be in operation next winter. A feature of this plant will be the provision of three generators for the two sets; the third being so placed and connected up that it can be used on either plant, as required, or remain out of action altogether. This will, of course, practically make the two sets equal to three plants; and as the same plan is to be adopted when putting down the remaining two sets, Mr. Morley will really get six plants out of the four. But this is looking some distance ahead.

Old retort-houses are being demolished to make way—so satisfied is Mr. Morley with the working of his new machine house—for one similar in all respects to that which was seen in operation by the members; and when this is done, and the existing house is extended as already indicated, and all the water-gas plant installed, the Grangetown works will have a capacity of 10 million cubic feet of coal gas per day (5 millions for each house) and 4 million feet of water gas. One thing which renders building operations on the works a little troublesome is the difficulty of finding good foundations. In most parts, they have to go down 16 feet; while in one portion of the works, to carry the gantry, a depth of 24 feet has been necessary.

Among other jobs now in hand is the construction of an oil-storage tank, which will have a capacity of 700 tons of oil. This is being so arranged that the contents of the oil-waggons can be discharged into the tank from the railway line which runs overhead. Among the other additions, four more boilers are to be put in—two for the water-gas plant, and two for the compressed air machinery for the reconstructed house, when completed.

A proof of Mr. Morley's care in taking precautions against accidents was seen in the shape of a small stock of Scotch cannel, which is kept as a reserve. None has been used for some years now; but it is, as he says, there in case anything happens. The last thing to be inspected was a miniature gas-works for coal testing purposes. This contains three clay retorts which take a combined charge of one-tenth of a ton—an amount found easy for calculation, and furnishing reliable results.

After leaving the works, the members returned to the city by car; and in the evening, Mr. Ward conducted a party to the Queen Alexandra Dock to inspect the installation of high-pressure gas lighting which he had described in the paper read by him earlier in the day.

EFFICIENT ILLUMINATION AND MUNICIPAL REQUIREMENTS.

A Central Testing-Station for Means of Illumination.

Municipal authorities perhaps more than other people require rousing to a sense of their duty in the provision of economical yet efficient lighting for the streets and public buildings and institutions under their control. The Municipal, Building, and Public Health Exhibition at the Royal Agricultural Hall should have formed an excellent opportunity for a full and free consideration of this question; and so among the "conferences" (which have consisted of the delivery of a lecture each afternoon with the "conference" a distinctly negligible quantity), arrangements were made for Mr. Leon Gaster to deliver a lecture last Wednesday on "Efficient Illumination and Municipal Requirements," with lantern illustrations. The attendance did not suggest that local authorities regarded the matter as of thrilling interest.

Mr. Gaster pointed to the well-known truth that until the last few years the question of illumination has not received recognition as being of any special concern to the gas and electricity engineer. The business of each had been considered to be to supply gas or electrical energy to the consumer, and not illumination. Therefore, it has been left to the consumer to do the best he can with the illuminant of his choice; and the result generally has been very poor indeed. The difference between light and illumination, as defined by the lecturer, is that light is the cause, illumination the effect. The object on which light falls becomes illuminated; and the object is "properly illuminated" when it can be seen without strain to the eyes. In considering the form illumination should take, it is absolutely necessary to have regard to the effect upon the eyes. Educational authorities are now having the sight of school children tested; and as in educational establishments work has at certain periods to be carried on during the hours when artificial light is required, it is of paramount importance—sight and light having a close relationship—that the best quality of light that will do the least possible harm should be provided. It is therefore necessary that there should be a thorough and proper test made of the illumination by means of which the studies of children are conducted. The influence of bad illumination is felt more than ever now, especially with the latest forms of illumination, the adoption of which require much and careful consideration. The amount of work that is carried on by means of artificial illumination continues to increase; and it is therefore of the gravest importance that all possible should be done to realize the most perfect physiological conditions for illumination. The harm that is done by bad illumination is really terrible. In schools, the minimum illumination needed has been fixed by one authority at 1 candle-foot. Around us is seen the increasing brilliance of sources of light; and high-pressure gas-lamps, the flame arc lamps, and the metallic filament lamps have drawn greater attention to this question of proper illumination. A prescribed brightness per unit of area is more than ever necessary; for the brilliancy of the unshaded arc lamp and the glow lamp is greater than should be physiologically accepted. Violent contrasts of shadows and flickering lights are also very trying to the eyes. Mr. Gaster here read extracts from reports of investigators into the question of the eyesight of school children, and regarding the indifferent illumination afforded under a past order of lighting arrangements. In this connection, he incidentally remarked that what constituted good and bad illumination can only be determined by illumination tests and testing methods; mere ocular demonstration is not sufficient.

Mr. Gaster therefore urged upon municipal authorities the importance of seeing that the system of illumination adopted in schools is dealt with in a proper, scientific manner, just as much as the testing of sight. Another class of public building that comes within the governing power of local authorities are public libraries; and those who heard Mr. Gaster found him an unsparing critic of the misuse of light in such places. The passages in many public libraries appear to receive the greatest attention from those responsible for the illumination, while the reading papers and the book shelves are less than sufficiently lighted. Adequate illumination where readers sit, with subdued illumination around, must be acknowledged to be the lines of correct illumination. In his opinion, what is necessary is that municipal authorities should appoint people expert in illumination and competent to test the latest inventions, to advise them on a proper scheme.

Turning to street lighting, Mr. Gaster said this is usually done in the most haphazard manner. Municipal authorities are composed of a number of citizens, with, of course, the utmost desire to do the best possible for their constituents. When, however, they have to deal with street lighting, a number of the councillors are elected to form a street lighting committee; and a certain amount of money is placed at their command which they thought they had to spend in one way or another for street lighting. How is this money to be most profitably spent? That is the question that in every individual case requires investigating.

Why not, asked Mr. Gaster, have a sort of municipal experimental station for illumination? Under the present circumstances, much money is wasted through improper street lighting. If those municipalities who own gas and electric lighting undertakings would only contribute a certain small sum annually, they could jointly maintain an experimental station where the latest developments in any system of lighting could be carried out. This would save the ratepayers the present heavy expenses on trial installations. At the present time, the electricity people give advice one way, and the gas people another way; and the result is the members of the authorities do not know where they are. For the conduct of such a central testing-station, a committee should be appointed, representative as far as possible, of the different illuminants. This committee should then carry on their experiments, and report to the contributors (say) every six or twelve months. Such experiments could be conducted in the most admirable way if only the gas and electric light people would enter into co-operation. In the States and in Germany, the gas, electric, and oil people work together in greater harmony. Why not here? inquired Mr. Gaster. He pointed to the claims made by inventors and manufacturers regarding the efficiency of their lamps; he instanced the statements made respecting flame arc lamps and metallic filament lamps; and he then referred—not in any questioning manner—to the declaration in the "JOURNAL" of the previous day that the James Keith and Blackman Company had, by the high-pressure system, succeeded in developing a burner and lamp giving the remarkable duty of from 60 to 70 candles per cubic foot of ordinary gas consumed, which efficiency is confirmed by Mr. W. R. Herring, of Edinburgh. However, there are all these new inventions brought out; but most local authorities have no proper means of testing the accuracy of claims. By each subscribing £10 or £20 per annum, they could equip a central testing-station, and could put a man in quite an independent position to carry on the work, under the direction of a Committee. This would be one of the best things that has ever been done for the street lighting of the country. He maintained that it is illumination for which the ratepayers pay, and that therefore illumination ought to be the basis of judgment of the most effective systems. Illumination is measurable; and, being measurable, it ought to be taken into consideration. Once more Mr. Gaster urged the claims of his scheme for an Illuminating Engineering Society; and he again asserted that it was high time the gas and electric lighting people left off fighting, and came together in a spirit of co-operation. In olden times, the electrical engineer was looked upon as a philosopher; the gas engineer was merely a man with a shovel. But people's minds have been disabused of such notions. Gas engineering is just as much a branch of science as is electrical engineering.

Following the last wise sentence, Mr. Gaster offered a few remarks on the subject of factory lighting. He expressed his surprise that so little is done in regard to the illumination of factories. We have inspectors to test water, air, and everything that affects the workman, excepting illumination. Many owners of factories cut down illumination to a degree that is disgraceful, for what they term reasons of economy. Such economy, when the years are remembered that people work in factories, is bad indeed for the eyes of the workers. These are economical views that are wasteful indeed.

One other point had regard to the great mistake that shop people make in putting in such powerful lights for shop window lighting that they are irritating to the eyes of passers-by. Such lamps, Mr. Gaster held, ought to be shaded.

On the motion of the Chairman of the meeting (Mr. Haydn Harrison), a vote of thanks was passed to Mr. Gaster for his lecture.

Professor F. T. Trouton will begin a course of two lectures to-day at the Royal Institution on (1) "Why Light is believed to be a Vibration," and (2) "What it is which Vibrates."

SOME NOTES ON NEW ELECTRIC LAMPS.

[Discussion at the Meeting of the Wales and Monmouthshire District Institution of Gas Engineers and Managers, May 6.]

The paper by Mr. J. H. Canning, of Newport, which gave rise to this discussion was presented (in the absence of the author) at the meeting of the Institution at Shrewsbury on Sept. 4, 1907, and published in the "JOURNAL" the following Tuesday.

The PRESIDENT (Mr. Edward Jones, of Burslem) said they had had in the paper an exposition of many of the fallacies of electric lighting; and he hoped there would be a good discussion.

Mr. T. CANNING (Newport) remarked that he felt a certain amount of reluctance in rising to speak on this paper, in view of his relationship with the author; but at the same time he wished to say a word or two. He would like, for example, to say that he did not agree with the writer in the estimate he gave with respect to the cost of electricity and gas. The value he gave to gas was only 16 candles per cubic foot; and, as they were aware, it was at the present time possible to obtain a higher result than this. In addition to this, he set out the electricity for the Osram lamps as being sold at 3½d. per unit. He (the speaker) quite disagreed with this, and maintained that it was impossible—that was to say, having regard to anything in the shape of sound commercial working. He assumed that here there would be a large introduction of these Osram lamps; and if there should be, he thought the electricians would find it impossible to supply current at 3½d. per unit, or anything approaching it. On the other hand, there was something omitted; but, of course, it was omitted in both cases. He referred to the capital costs behind the two—the supply of gas, and the supply of electricity. Now, there was a great difference between these capital charges. In fact, electricians themselves had recently been studying this question. There was one passage in the paper where the author stated that a "great fear was expressed by electrical engineers that the load-factors of these concerns, built up with such care, would be ruined by the employment of the more economical lamps." This had since become a fact; and electricians were in very great doubt at the present moment whether they would be able to carry on the supply of current to these lamps without very largely increasing their charge. In order to disguise this, several things had been proposed; and among them was one brought forward at a recent important meeting of electricians, that there should be a contract entered into between the electric supply authorities—whatever they might be, companies or municipalities—and the private consumers, making an annual charge for a certain amount of power, and beyond this a charge per unit equivalent to the works costs—that was to say, from about 0·95d. to 1d. per unit—in addition. Perhaps he could make it simpler if he put it to them in the way it had actually been brought into operation in Norwich, where the Borough Electrical Engineer had introduced a system that was working at the present moment—namely, of charging 12 per cent. on the assessable value of the house where the electric energy was used, and 1d. per unit for current taken. This showed that it was quite an impossibility for these very high power lamps to be introduced without diminishing the output from the power stations. He would make no comment whatever, but would leave it to them to consider for themselves the exceedingly ingenious device by which the electricians proposed to still keep up their revenue, and as it were prevent the consumer from finding it out. There was one other point he might mention in this connection. He did not agree with the author where he said the electrician was unable to subdivide his immense units of light. He thought he was, and that in this there was some considerable danger. Following up still the same point on which he began—the question of the rates to be charged for electricity, without permitting the consumer to know very much about the matter—there was a kind of tacit warfare going on between the consumer of electricity and the supplier. The consumer, when he adopted one of these Osram lamps, had got it into his head that he was about to obtain the same light for about one-third of the cost. The idea of the electrician was different; and it was that the consumer was to have three times the amount of light for the same money. When they came to reflect upon this, they would see at once how great a difference there was between the two positions. But this was the state of affairs at the present moment. Now, how was this object of the electricians to be achieved? He would tell them how—by this subdivision of the units of light. The present Osram lamp with long wires, giving (say) 32 candles nominal and perhaps 25 candles actually in working, was to be subdivided—to be shortened—into 8-candle and 16-candle power. This showed they could subdivide them, so as to scatter the lamps more conveniently about, and make the cost of repairs less. But this was where the danger came in so far as they were concerned—and it was of great importance in connection with a paper like the present one, which drew their attention so much to the points that they ought to keep their eyes fixed upon. How far were these new lamps going to be substituted in place of incandescent gas-lamps? In this way, by the subdivision of which he spoke (and going back to the principle which electricians had laid down of three times the amount of light for the same money), it was very easy to induce the consumer who had already electricity established on his premises, and who began to find his bill grow lighter in consequence

of the introduction of the Osram lamp, to adopt a few more. This was where the danger was, and where they would find the electrician would, unless the gas industry was very wideawake, begin to substitute his lamps for theirs. He did not think that upon this question of finance he had very much more to say, except that electricians had been altogether too ready to supplant gas, without considering the commercial result, so long as they got in and increased their output—made up what they termed a good load upon the station. They had been reckless; but now they had found out there was an enormous disproportion between the capital expenditure and the gross income, and therefore necessarily between the capital expenditure and the net profit. They found it was entirely different in regard to gas. In the working of a gas concern there was a very much larger margin when they compared these two factors—namely, the capital outlay and the gross income—than there was in the case of the electric lighting and power undertakings. He thought perhaps the most valuable portion of the paper, and one for which he thanked the author very much indeed, was his analysis of the flame arc. The only way to deal with a lamp of this sort was to analyze by the spectroscope the rays that came from it; and in this matter, of course, science had a great deal to say—it had not unfortunately always the last word to say. Popular prejudice he knew from experience was a very powerful combatant of science; and it took science a long time to overthrow it. At the same time, it was important that people should know that the use of a lamp like this was prejudicial to the eyesight. If they kept their ears continuously in the neighbourhood of a big drum, they knew very well they would become entirely deaf. So in like manner, if the delicate, sensitive nerves of the eye should be exposed to one set of rays continually falling upon them, they became, so to speak, inefficient as regarded other colours, and fatigued and irritated as regarded the colour that was being perpetually brought before them. He was not, however, going to dwell upon this point, because sometimes it was said by electricians when gas people had made a scientific demonstration of this kind, whatever was its real character, that it only came from a gas man. But he would like to draw their attention, not exactly to views that had been given in respect of this flame arc lamp, but to some statements on the physiological and hygienic aspects of gas lighting and lighting by electricity, which emanated from an authority quite independent either of electricity or of gas concerns. Some of them might possibly have seen the report to which he was going to refer only very briefly. It was in the "Journal of the Royal Sanitary Institute" for March; and practically the entire number was taken up with one paper only—which would show the great interest that was being taken in the question by the Sanitary Institute. The title of the report was "The Relative Hygienic Values of Gas and Electric Lighting," by Dr. Samuel Rideal.* The experiments were made in London; but he must refer them to the paper to see what was done, and how the investigations were carried out, as it would take too long to attempt there to describe even what took place. The object, as set out in the title, was a physiological and hygienic comparison of the two systems. The medical observations were made by Dr. Bertolacci, and the physical determinations by Mr. A. J. Martin; while Dr. Rideal dealt with the sanitary aspect. Coming to the results, and taking the question that he had been speaking of as to the spectroscope in regard to the flame arc lamp, he saw that they said, in reference to the ophthalmic experiments, comparing gas with ordinary incandescent electric lights—that was to say, where the carbon filament was not doctored and not impregnated, as was the case with the flame arc, with volatile salts—"The sensitiveness of the eye to light as measured in the Perception test is diminished very markedly after exposure to the electric light, while no corresponding effect is noticeable after the eye has been subjected to the gas light. The power of co-ordinating and using the motor muscles of the eyeball recorded in the orbicular muscle tests was diminished to a greater extent after subjection to electric than to gas light." The general result was that, while no harm ensued to the eye from the use of incandescent gas light, with electric light it was different. He was not going to venture for one moment to say that there might not be means by which electricians could overcome this difficulty. He merely wished to impress it upon them, on independent scientific authority, that the same trouble did not exist in relation to the gas which they supplied. There was another point to which he would like to draw attention. It had no immediate connection with the paper; but, as the members were aware, they had been so often attacked for the injury they did to the public health, especially by the production of carbonic acid in the burning of gas, that their concerns had suffered considerable harm from this prejudice—a prejudice which was unscientific, and which had been spread sometimes by men with a reputation for science. Now, these were the main conclusions on this point of the report to which he had been referring: "Owing to the better ventilation obtained by gas, the products of combustion are not found in the air in anything like the proportion which might be expected; the temperature and humidity in an occupied room being no greater than when the room is lit with electric light. Carbonic acid gas has not the injurious effect which was formerly attributed to it; but considerable rises in the temperature and moisture content of a room, from whatever source, do have a prejudicial effect upon the well-being of the occupants. Even under adverse conditions of ventilation purposely created for this inquiry, neither the temperature nor percentages of moisture in the room reached a point at which any such effect could be detected by any of the recognized physiological tests. It has been established that the products—heat, carbonic acid, and moisture—so far as they modify the health of the occupants of a room, are derived from the inmates more than from the illuminant, and that a room of moderate size can be efficiently lighted by gas without sensibly affecting the amount of these three factors"—heat, carbonic acid, and moisture. In another portion of the report, it was stated: "The gas-burners gave rise to stronger air-currents, and invariably produced a more active ventilation and diffusion of air than electric lights. Hence, along with the products of the gas-burning, the exhalations from the persons present were more rapidly removed." It was also found that the bacterial contents of the air of the rooms were less with gas than with electricity. Now, this was very important. If any of them went into (say) a large hall electrically lighted, and sat in the balcony during a performance, he would discover an extremely unpleasant atmosphere there which would not be experienced in a gas-lighted hall. Why was this? Because the products which arose from breathing were left in the air. Therefore he wished to draw their attention to this: "The bacterial contents of the air of the rooms were less with gas than with electricity, owing to (*a*) cremation of the organisms in the gas-flames; (*b*) sterilizing effect of the sulphur acids from the gas; and (*c*) increased condensation on the surfaces removing organisms, together with sulphur products. As a consequence, the condensed moisture under electric light contained a number of living organisms, while that under gas was sterile." He had mentioned this matter, though it had no direct connection with the paper, because he knew that they had suffered from the attacks that had been made upon them so unjustly in the past, and which went on to-day as if they had never been controverted. He was glad to find that these independent scientific authorities had contradicted these statements, and in the best way possible—by science. This was the reason why he congratulated the author of the paper that was now before them on having produced an analysis of the flame arc, in order that the injury which it might do to eyesight might be fully made known—as fully as science could make it. He hoped they would forgive him for the length of time he had taken up; but the subject was one that much concerned them at the present time, and one that entered into their daily working, because he knew perfectly well that, in order to be able to keep alive at all, electric lighting concerns would have to make another desperate, and let them hope a final, irruption into the boundaries of the gas industry.

Mr. R. A. BROWNING (Neath) said that the exhaustive criticism of the last speaker had left very little to say, so far as he was concerned. It was most refreshing to him to read the paper again after the time which had elapsed since it was submitted to them at Shrewsbury, because they had then only a small experience of the lamps. He could fully appreciate all the points of the paper; and he was sure everybody could do the same, if he considered his own practical experience with the lamps. With regard to the comparison of the cost of gas and electricity, he thought this was a feather in the author's cap, because he had understated rather than overstated the case for gas. He was on the right side to put the figures so as to disarm criticism. They had some electricity at Neath—having made an agreement with the South Wales Electrical Company to supply 20,000 units of electricity; and the new lamp they found had reduced the current required to a great extent. They could not shut their eyes to the fact that these lamps were an immense improvement on the old carbon filament lamps, and had brought down the consumption of electricity. At Neath, they wanted to sell 20,000 units of electricity, if they could; but these new lamps, being so economical as far as current was concerned, were keeping down the demand for the electricity which they had to pay for. On the other hand, he thought they need not be afraid of this. They were greatly indebted to the Technical Press for the way in which they brought forward this question of the Osram lamp, and gave full particulars in regard to it, as well as the experiences of everybody. This was the only way to meet the electricity people—by giving experiences, and watching the matter in every way. When they came across an inaccurate statement, they should refute it by circulating pamphlets among the whole of the consumers. By this means they could correct the assertions of the electricians, which needed to be corrected.

The PRESIDENT remarked that they would like to have Mr. Morley's experience of the Osram lamp.

Mr. H. MORLEY (Cardiff) said there were a large number in use in the city; but he had no particulars as to the actual cost as between them and gas. He knew, however, that it was a lamp that they had to fight against very much in regard to concessions in their prices.

Mr. H. D. MADDEN (Cardiff) said it was no use shutting their eyes to the importance of the flame arc and Osram lamps. If they looked at any shop which had been electrically lighted for a few years, they would see that the old carbon filament lamps were displaced. It was practically rare now to see a shop lighted by them. Of course, there were certain drawbacks to the new lamps, as the author had stated in his paper; and he heard the other day of a tradesman in Cardiff who complained that the light did not suit him, owing to the working having to be in series. But in going through the country, they would see a great invasion of the new metallic filament lamps displacing the carbon filament ones. In regard to their great opponent for high-pressure gas lighting,

* See "JOURNAL," Vol. CI., pp. 613, 686.

the flame arc, this spoke for itself. To see one fitted outside a shop was quite sufficient to condemn it; while for inside lighting he believed the fumes given off were a bar to it. Mr. Canning had ably refuted the electricians' statements; and his figures would be of the greatest value in fighting the new lamps, which had come to stay. The electricians meant if they could to push gas out; but if they would only give the gas industry a fair field with regard to figures, those furnished by Mr. Canning would help them materially to win the battle.

The PRESIDENT remarked that before closing the discussion he would like to say how much they were indebted to Mr. Canning for his paper, and also to Mr. Canning, senior, for what might be called his appendix to the paper. He (the President) had been placed in a somewhat peculiar position. The Electrical Engineer had seen fit to introduce into his district a pamphlet in which he described the electric lamp both from the photometrical and also the hygienic point of view. As to the photometry of the lamp, with a fair field gas would be able to hold its own; but there was no doubt that with regard to the hygienic part the electricians were unjust, and gas people were right to defend themselves. The report that Mr. Canning, senior, had referred to was one of the greatest possible importance; and it could not be too widely spread among the gas profession. Those who were not already in possession of a copy ought to procure one at once. It was one of the most valuable contributions that had appeared for many years. Probably they would remember that this matter was discussed by the Council of the parent Institution about the year 1905, as it was then deemed desirable that they should take the question up, and refute the many gross misstatements made about gas by their rivals the electricians. The Council agreed that this should be done; and a fund was started to do something. But the three London Gas Companies combined together. They found that the matter was so important that they took it up themselves, with the consequence that they had procured independent testimony to the great value of gas on hygienic grounds. Mr. Canning had quoted parts of it, which, taken in conjunction with the paper, would form a very useful reference. In his (the President's) own town, there had been issued a pamphlet which started off with "Do not throw this booklet away; it is worth reading." It dealt with "Some Advantages of the Electric Light." He was much interested in the hygienic part; with the lighting he could deal. He called the attention of the Committee to this attack on gas, and obtained permission to refute the statements made by the Electrical Engineer, who retorted by calling him a "jealous rival," simply because the price of gas was reduced 6d. per 1000 cubic feet. The Electrical Engineer in his pamphlet asked, "Who will deny that electricity is the cleanest illuminant known? Are you aware that when you burn coal gas you are being robbed of that which is essential to good health—oxygen? Are you aware that coal gas gives off a gas which is absolutely injurious to health—carbonic acid gas?" And so he went on the whole way through; and this was being circulated from door to door. The advice of the Electrical Engineer "Do not throw it away" was very important to them. If the paper they were discussing had done no other good than to bring forward the remarks by Mr. Canning, senior, they should be grateful for it.

Mr. J. H. CANNING, in replying on the discussion, said the first speaker, his respected relative, made a few remarks with regard to the estimate of the cost of running the Osram lamps and the gas-lamps. He purposely gave credit to the former and somewhat depreciated the gas-lamps, in order to show more strongly the advantage there was in using the latter in preference even to Osram lamps. With reference to charging the electric current at 3½d., this was the average amount charged for lighting during the year 1906 in Great Britain. As to the subdivision of the large units of light, he stated in the paper that the electrician was unable to subdivide his immense units of light; but this referred only to the flame arc. It was under the heading of the flame arc lamp that he mentioned it. As Mr. Browning said, the Osram lamp was certainly a remarkable improvement upon the carbon filament; there was no comparison between the two. The Osram lamp had, however, disadvantages. It was very fragile. A great number of the lamps were not able to stand the knocking about they got during transit from the manufacturers. In fact, it was only a few weeks since that an electrical engineer wrote to the "Electrical Times" stating that the average number of lamps smashed in consignments sent to him over a period amounted to about 32 per cent. This must add considerably to the cost of renewals, as naturally all these matters had to be paid for in the long run. Mr. Madden had alluded to the injurious effects of the flame arcs, and said the fumes emitted from them rendered it undesirable to use the lamps indoors. It might possibly be a surprise to Mr. Madden and others present to hear that he (Mr. Canning) knew of one instance at least of an office being so lighted, and at any rate one case of a large public reading-room (used possibly by several hundreds of people a day, if not over a thousand) in which the whole of the lighting was done by the flame arc. Anybody who had examined the flame arc would be well able to judge whether the violent flickering during the feeding of the carbons to the lamp could have other than a detrimental effect on the eyes of those who were reading (more especially small print) underneath them. Returning to Mr. Canning, senior, he had spoken of the sanitary aspect of the question, and also of the fact that in a room lighted by electricity, according to Dr. Rideal's report, injurious organisms and disease bearing germs were found to be very much alive, whereas in a gas-lighted room, if not completely killed, they were at least placed *hors de combat* for the time being. He did not wish to dwell on a matter which might be merely a coincidence; but a great number of people had remarked from time to time that since the introduction of the electric light the spread of influenza had been very great. As he said, it might be only a coincidence; but the electricians were so fond of making statements of the kind regarding gas, that it might be as well occasionally to give them something to answer. Then the President made some remarks as to the character of the literature issued by their opponents; and he (Mr. Canning) was sure they were all pleased to see the firm attitude he took up in refuting what might be termed the "terminological inexactitudes," contained in the pamphlet to which he had referred. It did not do to let these things get about. They were all too apt, because they knew themselves that the facts were not represented exactly as they should be, to think that other people held the same view. They did not. Such matters must be dealt with at once, sharply, firmly, and strongly; and counter literature should be issued. There was no reason, however, why they should lose the least bit of confidence in their position. Gas had done well in the past; and he was certain it would do very well indeed in the future. Take the Osram lamps at their best, and they still, for the energy used alone, cost twice as much as incandescent gas; while no comparison at all could be made as regarded maintenance. There they were out far beyond, not only gas, but any form of lighting. With every confidence gas people should continue, as Mr. Morley said, to fight against these lamps. They would have to fight them, there was no doubt; but in the long run they might be perfectly sure they would manage, as they had done before, to hold their own. He thanked them for the reception they had accorded to his paper.

HIGH-PRESSURE INCANDESCENT GAS LIGHTING AT THE QUEEN ALEXANDRA DOCK, CARDIFF.

By A. J. WARD, Manager of the Cardiff Railway Company's Gas-Works.

[A Paper read before the Wales and Monmouthshire District Institution of Gas Engineers and Managers, May 6.]

Before entering precisely into the subject of this paper, perhaps it would not be uninteresting to give you a glimpse of the past history and progress of the undertaking over which I now have control. Previous to the year 1872, the Bute Docks took a supply of gas from the Cardiff Gaslight and Coke Company. The same year saw the founding of the Bute Gas-Works—a private works, built by the late Marquis of Bute, for the supply of gas to the Bute Docks, for lighting and industrial purposes. In the first year of its existence, the works produced 16 million cubic feet of gas. After this the consumption rapidly increased, until, in 1882, it produced 27 millions; in 1892, 38 millions; in 1902, 54 millions; and last year, ended December, 1907, no less than 66 millions were made and distributed to the Bute Docks—thus showing the rapid growth made, not only in gas making, but in the progress of the commercial, industrial, and coal trade of the Cardiff Docks during the past thirty-five years.

From time to time extensions to the plant have been effected; so much so that the old works have been almost remodelled and supplanted with new apparatus of modern type. Within the last three years, the carbonizing plant, which was of the old direct-fired system, has been entirely replaced by modern regenerative retort-settings; so that the present works are capable of producing a maximum of 400,000 cubic feet of gas per day, or 80 millions per annum.

Having regard to the fact that the Cardiff Railway Company possess gas-works of their own, capable of a greater output than that which the present consumption demands, it is evident that the cost of gas for the lighting of their own dock could be done at the net cost of production, without involving the outlay of additional capital, which places them in an exceptional position as regards economy.

When the Queen Alexandra Dock was in course of construction, and nearing completion, the question of lighting it came up for consideration, and a favourable opportunity presented itself of suggesting to my Company the economy of lighting the new dock with gas on the high-pressure incandescent system—and this in preference to electric arc lighting, as being a far cheaper method, and giving equal, if not superior, results as regards light for large areas. The Company had no surplus power in their electrical station, and to extend it or build a new one would have involved additional capital; or there was, of course, the alternative of taking a supply of current at a profitable rate from the Cardiff Corporation. These circumstances were fully appreciated; the costs carefully analyzed; and, in the special consideration of our own particular conditions, it was finally decided to adopt high-pressure gas for the whole of the dock lighting.

The first question that engaged my attention was what burner should be adopted. Experiments were conducted with lamps and burners for stability, efficiency, economy, &c. I do not propose to weary you with the result of these trials, more than to say that

we finally decided to adopt the Keith burner, in clusters of three, four, or five in each lamp, for this installation.

In order that you may be able to appreciate the conditions of distribution, I would like to explain the circumstances which induced the disposition of the compressing plant for this work at the gas-works and not at the Queen Alexandra Dock, although the installation is situated at a distance of about 1½ miles from the compressors. The trunk main from the station governor supplying the whole of the Bute Dock district is a 12-inch cast-iron one. At a point about 300 yards away, the first 6-inch branch supply is taken off the 12-inch main. This takes a course along the Lewis Road, south side Roath Dock, and ends at the Roath Basin district, at a distance of about 3000 yards. Between the Roath Dock and Roath Basin, the Queen Alexandra Dock district commences, the new mains of which are connected to the old ones at this point. Now, this 6-inch main had become too small to adequately supply the demand made upon it, even before the construction of the new dock; and, therefore, it would have been futile to attempt to supply the extended area at ordinary pressure without replacing the 6-inch main with a larger one. To have fixed the compressors at the dock and pulled from this main would have reduced the pressure on the Roath Dock and Basin to vanishing point, unless a higher initial pressure was given by the governor over the whole area of the docks. To do this was considered inadvisable, wasteful, and unnecessary. By the plan adopted—viz., laying a piece of new 6-inch main from the compressors, connecting it to this branch main at the junction of the Lewis Road, and cutting it off by a valve from the 12-inch —we obtained an entirely new district supply, delivering the gas direct from the compressors at night and through the station governor by day, at whatever pressure required, and entirely cut off from the other portion of the docks. This boosting arrangement provides not only the necessary high-pressure for lighting the new dock, but gives an adequate supply of gas to the extreme end of the Roath Basin district with the same mains.

The compressing plant received a good deal of attention. It is one of the most important factors in affording effective, reliable, and economical working; and several types were considered. The steam-turbine blower was very favourably regarded; but, owing to our existing boilers being rather old and not capable of carrying the pressure of steam necessary for the economical working of these machines, it was abandoned. The rotary exhauster being a positive machine, and not, as far as I am aware, capable of giving a perfectly steady gauge, and, in the case of breakdown, the liability of relief or bye-pass valves not always acting at a critical moment, caused a feeling of uneasiness in adopting this kind of compressing arrangement—it being imperative that contingencies of this kind should not occur. Therefore it was decided to adopt the centrifugal fan or blower, as the safest and most reliable apparatus for the work, because, if these machines should stop through any cause, as they may, one can depend on the gas passing into the main at a reduced pressure, such as may be at the inlet. In our case, there is always 57-10ths or 36-10ths, according as to which gasholder may be used at the time. Accommodation for the plant was available in the governor room, which measures 25 feet by 14 feet; the station governor and connections occupying only one-half of the area. In this space, the compressing plant was fixed.

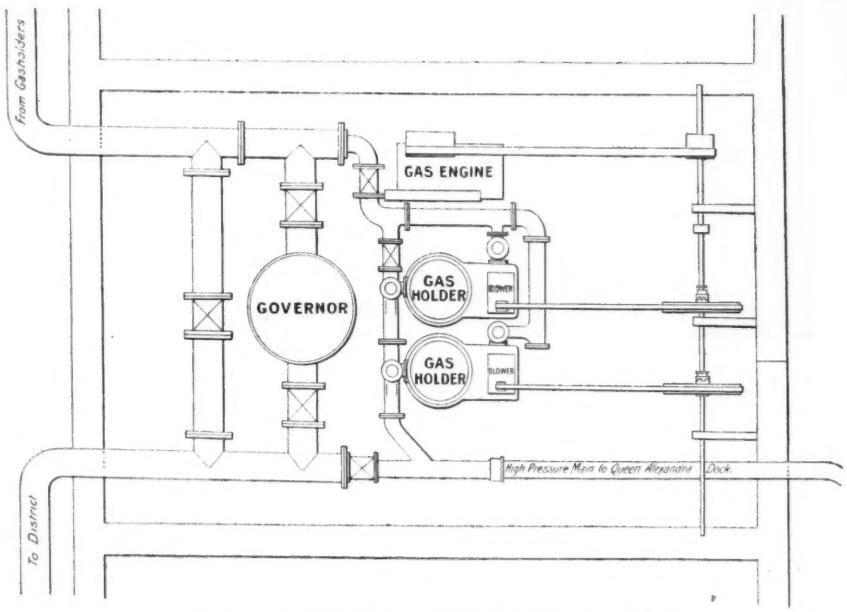
It comprises two Keith centrifugal blowers, each having a delivering capacity of 15,000 cubic feet per hour and giving a maximum initial pressure of 15 inches. These blowers have each (attached to the same bedplate) governing gasholders, into which gas from the fans is delivered, preparatory to being delivered to the main. By weighting the holders, the desired pressure—within the limits of 12 to 15 inches—can be obtained; 12 inches being the initial pressure carried at present, as only 10 inches are required at the lamps. The blowers are driven by a 6 brake-horse-power gas-engine, by belting through a countershaft; and they can be also driven through another shafting, used for pumping purposes, by a steam-engine driving a reciprocating exhauster—thus securing two drives for the plant, and giving double security against prolonged stoppage through any cause. The gas-engine runs at a speed of 200 revolutions per minute, giving a velocity to the blowers of 3000 revolutions per minute. This speed is kept up during the whole of the run; and no anxiety whatever is felt for the overheating of the bearings, which are lubricated by a special syphon action, which is most reliable. Only one blower is at present run at a time; but for periods of heaviest demand, the two may be run together. Otherwise, they are worked alternately, week by week.

The connections to the blowers are taken from the inlet and outlet of the station governor, and valved off from each other, so that the governor can be used to control the pressure in the Queen Alexandra Dock main during the daytime when the blowers are not working; and when the blowers are started at night, the governor can be cut off from this district.

Perhaps I may be permitted to explain here the method of operating the plant for the simultaneous lighting and extinguishing of the lamps at the dock. In lighting up, the inlet valve to the blowers is turned on and the outlet valve from the governor immediately shut off. This not only cuts out the governor, but gives a direct supply to the district from the works gasholders. The plant now being ready, the gas-engine is started. Then the blower is gradually put into gear by running the belt off the loose on to the fast pulley, and, attaining the normal speed, raises the pressure to the required amount. This increase of pressure to 12 inches is soon felt over the district. The high-pressure mercurial governors, coming into play, control the pressure at private consumers' services; the pressure simultaneously operates the mercurial seal bye-pass fitted in each lamp pillar; the pilot light, being ready, ignites the burners; and thus the automatic lighting of the lamps around the dock is effected. The reverse order produces the reverse effect—viz., extinguishes the lamps. At the same time no interruption to the low-pressure supply is felt, as the station governor is again brought into action to control the day pressure, which never falls below 15-10ths. Thus we are able to emulate, in this installation, the electric light in the longed-for desire of being able to switch on and off our light.

A few words about the Queen Alexandra Dock will not be out of place in affording you an idea of the extent and nature of the surrounding area to be lighted, and the work which is carried on there. The dock covers an area of 52 acres. It is 2550 feet in length, and 800 feet in breadth; the extent of wharfage space being about 2500 yards. The south side is set apart for the export coal trade, and equipped with powerful patent coaling cranes and movable staiths, together with the necessary sidings for the storage of coal. The north side is equipped with hydraulic and electric cranes, transit sheds, warehouses, and large storage grounds for the discharge of vessels in the import trade. The deep-water entrance or sea-lock, which is 850 feet long by 90 feet wide, affords facility for the locking in and out of the largest vessels afloat, and also provides considerable advantage in docking vessels at various states of the tide, even at low water.

The lighting of the coaling berths on the south side is effected by 1000-candle power high-pressure incandescent lamps, set at a distance of 100 feet apart and 60 feet from the coping. These lamps are disposed in the centre, between nests of railroads, which transfer the trucks of coal from the sidings to the staiths. The staiths are of the traversing type. This spacing and power of the lamps afford a splendid light to the workmen at all points, in carrying out the difficult and dangerous operations of tipping coal at night.



Gas-Compressing Plant at the Queen Alexandra Dock, Cardiff.

The north side is lighted by 1000-candle power lamps spaced 180 feet apart. This affords ample light for the class of work carried on in the import trade, which is found not to require the same expenditure of light as the coaling berths, because reflection helps the light here to some extent, whereas the coaling berths offer no such assistance, being as black as a photometer room.

The sea lock is lighted by 1000-candle power lamps set 120 feet apart and 40 feet from the line of coping. At either end of the lock, one on each side, 1500-candle power lamps are placed. There are in all twenty 1000 and four 1500-candle power lamps fixed on this entrance lock and piers—making a total of 26,000-candle power, which you may imagine illuminates the whole of the

water area of the entrance channel and the surrounding ground in a very elaborate manner. Of course, the whole of these lamps are not lighted when no work of locking vessels is in hand; the lamps being under the control of the dockmaster, to be used as he requires.

The lamps are of hexagonal shape, made of heavy copper, 36 inches across the waist, and fitted with steel enamelled concave reflectors. The astragals are strengthened with internal steel rods; and, in addition to this, ⅝-inch iron stays are fixed, connecting the shoulders of the lamp by angle brackets with the cast-iron base. This forms a substantial truss to the lamp, minimizing the vibration in times of storm and high winds, which frequently prevail at this exposed situation.

The anti-vibrating device is a matter upon which a lot depends for the lifetime of the mantle, and in this case much time and thought were given to secure the very best means of counteracting the evil of vibration. After much experiment, the present arrangement was adopted. The device is the one known as the suspended ball or pendulum type, in which the cluster of burners attached to a body and down rod tube is suspended from a spring at the top of the lamp. A heavy weight attached to the bottom of the down rod keeps the spring at the top in a condition of compression, and neutralizes the dithering vibration found near railroads when trains are passing by. The swinging arrangement also neutralizes the vibration caused by heavy gusts of wind in squally weather, which, in my experience, utterly destroys the mantles in any other anti-vibrating arrangement subject to similar conditions. The gas is conveyed through three rising tubes set in the angles of the lamp, and thence, by way of outward arms in the form of a tripod, from the apex of which depends the anti-vibrator, bye-passing this, through flexible metallic tubes to the down rod tube and burners, which are free to swing to and fro.

A View of the Coaling Berth at the Queen Alexandra Dock. (Taken at Night.)

The down rod tube, instead of being cut off at the three-way body, is extended through the cast-iron weight and capped off underneath. This arrangement forms a dust-box, and catches any particles of dust or extraneous matter that may be carried forward with the gas. A gauze-wire thimble is also fitted in the three-way body, which acts as a filter, and is found very useful in prolonging the periods for cleaning the nipples.

All the lamps around the dock (of which there are at present about 50, exclusive of those on the lock) are supported on high standards made of Mannesmann steel tube, stepped in three sections, of 8-inch, 6-inch, and 4½-inch diameter from bottom to top —making over all 31 feet; 6 feet being in the ground, 25 feet above ground, and a total height of 28 feet to the burners. These poles are each provided with a door, 3 feet from the ground level, with lock and key, in which is placed the mercurial seal bye-pass fitting for the automatic lighting arrangements. Ladders, platform, and guard rail complete the equipment of each pole—thus giving ample facility for the easy manipulation of the burners and the cleaning of the lamps.

The lamps on the sea lock are similar in design to those on the dock, but are supported on ornamental cast-iron columns of elegant design, and 20 feet high to the burners. All the auxiliary lighting—such as warehouses, hydraulic engine-houses, and weighing-machine houses, are provided with Welsbach self-intensifying lamps and the "Graetzin" 120-candle power inverted burner at ordinary pressure; high-pressure mercurial governors being applied for reducing the pressure for this purpose. The coal staiths are lighted by 1000-candle power high-pressure lamps, supported from the roof of the staiths.

The mains surrounding the dock are of Mannesmann steel, 6 inches in diameter. These, I consider, are more suitable than cast iron, having regard to the probable subsidence of the ground, which is mostly made up. The service-pipes are connected to the main by cast-iron clips, secured with four ⅝-inch bolts, and are found to be satisfactory in providing a strong and perfectly gas-tight joint under any pressure ever put upon them.

In conclusion, I should like to say a word about maintenance. Maintenance is one, if not the principal, factor in producing high efficiency; and I cannot too strongly impress upon anyone who may be contemplating high-pressure work to see to this, as in my experience it helps to attain the desired end of holding our ground in the fight for supremacy in the practice of artificial lighting to-day and for the future. If this point is not attended to, it offers a forcible argument to our competitors to push their systems against ours, and may lead to our ultimate defeat. In the present installation, in this respect I may say it involves the greatest difficulty and the utmost vigilance, in order to maintain the highest possible efficiency—subjected, as it is, to the clouds of coal dust which envelope the lamps, getting into the burners, and choking them up. Also, the gales and frequent strong winds prevailing in such a situation give no little anxiety for the welfare of the mantles; and, what is more, the reputation of high-pressure incandescent lighting, such as the one described.

Discussion.

The PRESIDENT (Mr. Edward Jones, of Burslem), in inviting discussion, remarked that they had had a paper the practicability of which could extend beyond even the area of docks.

Mr. H. MORLEY (Cardiff) said he would like to ask Mr. Ward whether he could give any information with regard to maintenance. He knew that the lamps were erected in a very exposed position. They were subjected to the full force of all gales; and there was also a good deal of vibration from traffic. He would be pleased if the author could tell them whether the renewal of mantles was a source of serious trouble and expense.

Col. OAKDEN FISHER (Cardiff) inquired whether the steel mains had been down long enough to prove that they made a good lasting job. He was pleased to note from the author's experience that they could now get a joint with which there need be no anxiety. He was connected with a gas company in a colliery district, where a considerable amount of trouble had been met with; and the question of using steel instead of iron mains had been brought before them. He was sure that what gas companies had to do in the present day was to keep their customers satisfied. The more they looked after them, and went after them, the better it would be. They had in Cardiff, as all the members knew, very severe competition; and they found it was absolutely necessary that they should look up their customers as frequently as possible, so as to take care that the lighting and everything was perfectly satisfactory.

Mr. H. D. MADDEN (Cardiff) asked why Mr. Ward determined that the lamps should be 31 feet in height, and whether it would not have been better to have separated his units of light, and brought them to a lower level. It seemed to him that he might have reduced his mantle expenditure by employing lamps 10, 12, or 15 feet high. Was there any factor in determining the height of 31 feet? because it seemed to him that the higher the lamp went up, the greater must be the vibration experienced?

Mr. T. CANNING (Newport) remarked that it ought to be a matter of pride, he should say, to the whole of the gas profession that, in a great commercial city like Cardiff, an important dock—a dock, too, used for coal shipping—should be lighted so effectively, so well, in fact, so much better, by high-pressure gas than by any other form of artificial illumination. It was certainly something to be taken very careful note of. They had at Newport, as the members were aware, a high-pressure system—not exactly for purposes of this kind, and not quite of the same type, because they supplied the whole of a district with the gas, and they had no small governors. The gas was controlled by a set of governors for the whole of the district. With regard to the author's remarks about the use of an exhauster as a compressor, he would like to point out that in the exhauster form a compressor had been invented, and was working under his own (Mr. Canning's) supervision with very great success. It was, however, something more, of course, than an exhauster; it was a veritable compressor. As to what was said in the paper about the bye-pass valves and relief valves not always acting at a critical moment, the author need not have any great fear of their getting out of order, though, of course, this was possible, as was the case with the valves and lubricators of any machine he might employ. They were not like the bye-pass valves of an ordinary exhauster, or the relief valves about a works, which might be put in action once every seven years. They would be in action several times during every twelve hours, so that the possibility of them getting out of order need not really be taken into account. He had employed Mannesmann steel mains for the purposes of high-pressure gas; and one of his reasons for doing so was that these tubes were a great deal less liable to fracture than was the case with cast-iron pipes. It appeared to him that in going up to very high pressures, it would be necessary to adopt a quite different joint from the one ordinarily used for cast-iron mains. He was now lighting one dock at Newport by gas; and he hoped soon—seeing the success of this —that he would be lighting them all. Mr. Ward's was a most workmanlike adaptation of gas to the lighting of a dock.

Mr. A. H. BROOKMAN (Tenby) asked whether the author could tell them the difference between the initial photometrical power

of the gas and the ultimate power when delivered at the lighting point. Personally he had had no experience with high-pressure gas; but he had always understood that, by compression, the lighting power of the gas was largely decreased, over and above what would be the case otherwise.

Mr. J. H. CANNING (Newport), referring to the working of the mercurial seal bye-pass, by which the lamps were automatically switched on and extinguished, inquired whether, in case the centrifugal blower broke down at any time, it would not have the effect of throwing all the lamps out of action.

The PRESIDENT said that, before asking Mr. Ward to reply, he would like to bear testimony to the fact that the paper was an excellent contribution to the "Transactions" of the Institution. In it, was contained a great deal of information regarding the ground that was now being covered by distribution. It was only a question of finality, as to what high pressure was. Their lowest pressures now were more than they used a few years ago to term high pressure. His lowest pressure was 2½ to 3 inches; and he went up to 4 or 5 inches. He had had some little experience of the matter dealt with in the paper, as he had five or six systems of high-pressure lighting in his district, working in close competition with electric arc lighting. The Doulton Pottery Company were so pleased with high-pressure gas that they were extending it through the whole of their place; and when he told them that the firm employed from 2000 to 3000 hands, it would show the extent of their premises. He had also got a portion of the town on high-pressure lighting upon the Keith principle. With regard to the Mannesmann steel mains, he, together with Mr. Ward and Mr. Canning, failed to see that they could revert back to the old cast-iron pipes. He was now using Mannesmann tubes exclusively. With them his experience was that he had fewer fractures; and in the matter of leakage—especially in districts which were undermined—he found they were the salvation of the system. The joints, of course, were a matter for special attention. He complimented Mr. Ward on the clever and scientific way in which he had faced the question of lighting the dock. Certainly, if such a system could be carried out in a dock like this, where there was so much vibration and dust—in fact, everything that tended to counteract good working—he thought it ought to be taken up very freely.

Mr. WARD, after thanking the members for the manner in which they had received his paper and for their discussion upon it, proceeded to reply to points that had been raised. With reference to Mr. Morley's question as to the cost of maintenance, he said that the special arrangement of anti-vibrator adopted had been the means of enabling them to get at least two months' life out of the mantles. This lifetime might not sound very long to some of them, having regard to experiences with internal lighting; but he thought those who were acquainted with external lighting practice would agree with him that the period he had named was a very favourable one. With any other form of anti-vibrator of which he had knowledge, he had not been able to get a month out of them; and, moreover, at times of storm and gale, the whole thing had been entirely demolished. With the type he had adopted, he had gone through periods of gales with only a loss of about 5 per cent. of the mantles. With reference to the cost of lighting, of course, they must take into consideration the special circumstances of the case. The Railway Company were the manufacturers as well as the consumers, and they were able to supply the gas at the net cost of production. At this figure, they were in a position to get 1000 candle-power-hours for ½d. This, he thought, was at least 50 per cent. less than quoted estimates for other installations where gas was bought from a private gas company or from a corporation. As to Colonel Fisher's inquiry in regard to the steel mains, he might say that he was exceptionally pleased with them. For a position such as they had for them round the dock—where the whole of the ground was made up—they were, judging by his experience of cast-iron mains in such positions, certainly far and away better. They had had to endure considerable expense in consequence of the continual fracture of cast-iron mains around the docks, where heavy traffic was passing in close proximity to the main. He did not think there was any fear of corrosion, because every pipe was covered with jute cloth steeped in solution; and, in addition to this, before the mains were finally covered over, they gave them another coating of tar and pitch. The joints were made with lead wool; and his opinion was that this was very much better to withstand heavy strains and pressures. He had tested some of the joints up to 200 lbs. per square inch, and had also put a heavy load on the centre of the joint, and suspended the pipe at either end; and the joint withstood the test without showing the slightest leak. With a cast-iron main, he was afraid this would not be the case. Again, using the lead wool they were able to secure a far greater density of the lead in the joint, because immediately they got a turn round it, they commenced caulking, and repeated this each turn. As to Mr. Madden's inquiry on the subject of the height of the lamps, and his suggestion that it would have been a means of saving mantles and reducing the maintenance account if the lights were not fixed so high, he agreed that low columns would be better from this point of view; but they would be absolutely useless to light the wharfage space of a dock, where there were lines of rail-road trucks loaded with timber, and so on. Lamps of 9 or 10 feet would be absolutely obscured between two trucks of timber. Mr. Madden was not correct in assuming the lights were 31 feet high. This was the length of the pole; but the lights were 28 feet from the ground, and, being fixed 60 feet from the coping, shed their light right on to the coping line, and at the same time were kept back out of the radius of the cranes. With reference to Mr. Canning's remark about the exhauster, he (Mr. Ward) was not aware that they could get an exhauster which would be equipped with relief valves and would be absolutely reliable. He was fearful in this respect; and being fearful, he thought he would not trust to it. Consequently, he adopted the centrifugal blower. If this should stop—and it had stopped—they got the gas passing through at the pressure of the gasholder, according to which one they happened to be working. As to Mr. Brookman's query, the initial pressure at the works was 12 inches, and that at the lamp was 10 inches; so that there was a loss of 2 inches of pressure. As, however, the makers stated that at 8 inches pressure the light given would be 300 candles per burner, he assumed that with 10 inches he got a higher duty than this. Taking all things into consideration, he would say that they obtained at least 1000-candle power from each lamp of three burners.

Mr. BROOKMAN: How much do you get from the increased pressure?

Mr. WARD said he took it that at 10 inches pressure they obtained an effective illuminating power of not less than 30 candles per cubic foot; whereas at low pressure he thought he would not get above 25 candles, and perhaps not so much. Mr. Canning reckoned in his paper a 64-candle power burner as consuming 4 cubic feet per hour, which was only 16 candles per foot.

Mr. CANNING: That is below the mark, and applies to ordinary, not high, pressures.

Mr. WARD (continuing) said he was not able to give the members any photometrical tests. Mr. J. H. Canning asked what would happen if the compressor broke down. The fitting in the lamp pillar contained a trough of mercury in which was inserted a floating bell, which was weighted to resist 20-10ths pressure. When this pressure was exceeded, the bell would lift out of the mercury. They were working from two gasholders—one of which gave them 30-10ths and the other 36-10ths when uncupped, and when cupped 57-10ths. They usually worked from the second, which gave a minimum initial pressure of 36-10ths; but generally they endeavoured to work this dock on the holder when cupped—that was, at 57-10ths. They obtained then, he assumed, at least 4 inches pressure, which was sufficient to keep the bell out of the mercury, and retain the lights. This had occurred; and the lights had been kept going, though, of course, the loss of power was most noticeable. In addition to this, if the stoppage should be a long one, the attendant on the dock (who was there the whole of the night looking after other matters) had an instruction, should he see the lights flickering, to go round the dock and immediately turn on the bye-passes. The moment this was done, they got a steady light—of half duty—on low pressure. On one occasion, the compressing plant had to be stopped in consequence of a belt breaking; but the interruption was for ten minutes only. Of course, they had duplicate machines; and, in addition, if the gas-engine should break down, they had a steam-engine with which they could also drive the plant. But the reason for providing the bye-pass was more especially for purposes of economy, because on Saturday and Sunday nights, when no work was in hand at the docks, they did not think it necessary to give so much illumination; and, consequently, they sent a man round to turn on the bye-passes, so as to work on the low pressure—that was, an initial pressure of 57-10ths, and at least 4 inches at the dock.

Coal Exported Last Year.

In the House of Commons, on Monday last week, the Chancellor of the Exchequer (Mr. Lloyd-George) put on the paper, in answer to a question by Mr. Hicks Beach, the following particulars as to the total quantity of coal exported from the United Kingdom last year, including the estimated coal equivalent of coke and patent fuel:—

	Tons.
1.—Coal	63,600,947
2.—Coke	981,418
3.—Coal equivalent of coke	1,635,697
4.—Patent fuel	1,480,893
5.—Coal contained in patent fuel	1,332,804
6.—Coal shipped for the bunkers of steamers engaged in foreign trade	18,618,828
7.—Total coal shipped (Nos. 1, 3, 5, and 6)	85,188,276

It was explained that the figures in line No. 3 had been computed on the assumption that for every 60 tons of coke exported 100 tons of coal were consumed in its manufacture. In the case of No. 5, the patent fuel exported had been assumed to contain 90 per cent. of coal; the remaining 10 per cent. consisting mainly of pitch. The figures given in No. 6 relate to the coal shipped on board British and foreign passenger and cargo steamers bound for foreign ports. The estimates as to the coal equivalent of the coke exported and the coal contained in patent fuel had been made on the basis adopted by the Royal Commission on Coal Supplies in their final report.

Mr. Levi Monk, the Manager of the Lewes Gas-Works, requests that all letters may be addressed to him as usual until the 23rd prox.

THE EFFICIENCY OF ARTIFICIAL ILLUMINANTS.

By Dr. H. Lux (Abstracted).

(*Concluded from p. 236.*)

The Author's Results.

Experiments on the lines already described were carried out with thirteen different sources of light—the hefner lamp, the paraffin oil-lamp, acetylene, an upturned incandescent burner, inverted incandescent burner, carbon filament glow lamp, tantalum lamp, osram lamp, direct current arc, alternating current arc, flame arc, enclosed arc, and mercury vapour lamp. Most of the data obtained directly, and the figures calculated from them, are collected together in Table V., towards the end of this article; but in certain of the more important cases, some of the details of the work undertaken, and of the intermediate stages in the experiments, appear of sufficient value to warrant more minute consideration.

Hefner Lamp.—Owing to its acceptance as a standard of light, the phenomena of the radiations emitted by a hefner lamp are of unusual importance. The lamp was examined by Tumlirz in 1889, who found the total radiation to be equal in electrical units to $6{\cdot}17 \times 10^{-5}$ watts; the light rays in the total radiation amounting to 2·4 per cent. As Angström pointed out some years afterwards, this last ratio is too high; the error being due to the employment of water by Tumlirz for separating the visible from the invisible rays. Angström's own figure for the total horizontal radiation at 1 metre distance was $8{\cdot}95 \times 10^{-5}$ watts per square cm., and for the horizontal light radiation $8{\cdot}08 \times 10^{-7}$; whence he calculated the proportion of light in the total radiation to be 0·90 per cent., with a probable error of $\pm$ 0·04 per cent. On the assumption that the radiation of the hefner lamp was composed in all directions of the same proportions of luminous and non-luminous rays, Angström's figures represented the total spherical radiation to be 11·25 watts, and the total light radiation 0·102 watt. This last figure appears in all literature under the name of Angström's absolute light unit, or "η."

In Lux's own experiments, the horizontal total radiation of the hefner lamp was shown to be $8{\cdot}39 \times 10^{-5}$ watts per square cm., and the horizontal light radiation to be $7{\cdot}49 \times 10^{-7}$ watts per square cm. Hence, the total spherical radiation was 10·55 watts; the total light radiation, 0·0941 watt; and the ratio, 0·89 per cent. It will be seen that Lux's value for the horizontal total radiation is only 6·26 per cent., and for the horizontal light radiation only 7·3 per cent., different from the corresponding values quoted by Angström. In view of the difference between the methods of measurement employed, and of Angström's statement that his results should be accurate only to within about 3 per cent., the agreement may be considered very satisfactory, more particularly when it is remembered that Lux was not able to make any allowance for the water vapour and carbon dioxide in the laboratory atmosphere. Regarded from another standpoint, the excellent agreement shows that a strong solution of ferrous ammonium sulphate answers the purpose of a light filter in every respect.

In order to eliminate any possibility of error lurking behind the assumption that the radiation of a hefner lamp contains the same proportion of light rays at all angles with the horizontal, Lux proceeded to examine the lamp at angles of 10° apart, with the Rubens thermopile in the manner already described. On preparing polar and Rousseau diagrams from the numerical data, and submitting the curves to planimetry, Lux found the ratio of the mean spherical radiation to the horizontal radiation to be as 121·6 : 128. So that if the horizontal total radiation was equal to $0{\cdot}839 \times 10^{-4}$ watts per square cm. (*ut supra*), the mean spherical total radiation must have been $0{\cdot}793 \times 10^{-4}$ watts, and the absolute total spherical radiation equal to 9·96 watts. The illuminating power of the hefner lamp was next determined at every angle of 10° with the horizontal on a Lummer-Brodhun photometer, with the aid of Krüss's reflecting stand. The standard light was an osram lamp intended for use at an E.M.F. of 3 volts; a resistance being inserted in the circuit until the light rays had the same tint as those of the hefner lamp. The figures showed the mean spherical illuminating power of the lamp to be equal to 0·825 hefner unit. The figure already given for the total light radiation therefore requires correction, and becomes $0{\cdot}825 \times 0{\cdot}0941 = 0{\cdot}089$ watt; whence the mechanical equivalent of one spherical hefner or η is $0{\cdot}089 \div 0{\cdot}825 = 0{\cdot}108$ watt—a value which only differs by about 6 per cent. from Angström's equivalent. It may be of interest to add that Lux's hefner lamp consumed 9·25 grammes of chemically pure amyl acetate per hour, having a heat of combustion equal to 7971 large Calories. To whatever extent the laws relating to the radiation of a "black" body may be applied to the flame, its maximum temperature, according to the Stefan-Bolzmann law, should be 1450° on the absolute scale.

Carbon Filament Lamp.—In spite of recent advances in the electrical industry, the carbon filament lamp is still far more important from a practical point of view than the different metallic filament lamps and the Nernst. The carbon filament is much cheaper to construct, can be connected to any distributing system, will burn in any position, and is much less fragile than such an illuminant as an osram lamp. On the other hand, the carbon filament lamp loses its original illuminating power so quickly that it cannot be considered to have a useful lifetime of more than 300 or 400 hours. The actual lamp examined by Lux was intended for connection to a 220 volt circuit; and was supposed to develop 32 hefners in a horizontal direction. During the tests, the lamp was fed from the public electricity supply mains with direct current maintained accurately at a pressure of 220 volts; the consumption of current being 0·446 ampere, equal to 98·23 watts of energy. On examining the figures relating to the lamp recorded in Table V., it will be seen that allowance has been made (in the manner already described) for the absorption by the glass of the bulb for all rays having wave lengths exceeding 3 μ; two figures being given in columns 3 and 5 to allow for this. Allowance has also been made for the amount of light absorbed by the ferrous ammonium sulphate solution, which cell, in the case of the carbon filament lamp, had an absorption coefficient of 1·915. The figure in the last column of the table proves that the efficiency was bad, scarcely exceeding that of the hefner lamp. The efficiency in question could be increased, albeit at the expense of the lifetime, by driving the lamp at a somewhat higher temperature; the illuminating power being actually doubled by impressing about 130 watts, instead of 98, upon the lamp. Hence it is obvious that the chief task before the manufacturer of carbon filament lamps is to make them better able to bear high tension current. Experiments in this direction are now in progress, and have already led to very promising results; but as patents are pending, it is impossible to give further particulars on the present occasion.

Nernst Lamp.—The Nernst lamp examined by Lux was a one ampere lamp with a vertical filament. It was supplied with current at 220 volts, and consumed 0·84 ampere or 181·4 watts. All other figures relating to its investigation are given in Table V.; two values appearing in three of the columns, as allowance was made for the energy consumed by the resistance belonging to the lamp. The considerable difference in the last column, for the energy equivalent of one spherical hefner from that recorded for the hefner lamp, is explained by the very different composition of the light. Nevertheless, though somewhat more efficient than the carbon filament lamp, the Nernst lamp is still a very uneconomical method of developing light. The author questions whether it would be possible to improve the efficiency of the Nernst lamp, as the glower is particularly sensitive to excessive E.M.F.

Tantalum Lamp.—The tantalum lamp has already been examined by Wedding, Roeder, and Waidner and Burgess. Wedding found that only 0·866 of the energy impressed upon the tantalum lamp was recovered in the form of light; but Roeder, and also Waidner and Burgess, found the ratio to be 4·3 per cent.—a value which agrees fairly well with that obtained by Lux.

Osram Lamp.—According to the patent specification, the filament of the osram lamp is composed of an alloy of osmium with some other refractory metal, usually tungsten (wolfram); the two metals being caused to unite after the filament is prepared. Hence the osram lamp occasionally increases in illuminating power after being alight for some time. For example, one small lamp intended for a 12-volt circuit originally gave Lux a horizontal illuminating power of 7·9 hefners; but after it had been alight about 100 hours, the illuminating power rose to 9·25 hefners, at which point it remained constant for several hundred hours longer. The osram lamp tested by Lux in the course of his investigation was intended for a 110-volt circuit, and was rated to develop 32 hefners in a horizontal direction. Its actual illuminating power, together with the other data, will be found in the table. The osram lamp, it will be observed, is somewhat more efficient than the tantalum lamp, and, like all lamps composed of filaments of refractory metals, withstands very high temperatures. Thus an unusual proportion of the total radiation occurs in the region of visible rays, the light appears unusually white, and the economy is much greater than that of the carbon filament lamp. It is manifest that the higher the temperature at which a metal melts—provided, of course, it does not evolve vapours before fusing—the higher is the specific energy which can be impressed upon a filament composed of it, and the higher is the economy of the lamp, even when no selective radiation, or only a very little, occurs. Moreover, the metallic filaments do not contain occluded gases, and therefore do not disintegrate during the passing of the current. Hence the globes are not blackened, and the illuminating power remains sensibly constant throughout the whole lifetime of the lamp. On the other hand, all metallic filament lamps have a disadvantage over and above their high first cost, inasmuch as they cannot easily be constructed for use on circuits exceeding 110 volts; and they therefore tend to prevent the introduction of higher voltages in distributing systems—one of the objects for which practical electricians are now striving.

Incandescent Gas-Burner.—A proper examination of the radiation phenomena of an incandescent gas-burner is encompassed with peculiar difficulties. If the burner is examined when working in normal conditions—that is to say, with its glass chimney in place—incorrect figures are obtained for the total radiant energy, because the glass exercises some absorption upon the rays exceeding 2·7 μ in length. If the chimney is removed, combustion is interfered with, becomes slower, causes the temperature of the flame to fall, and so, in a far greater ratio, reduces the total radiation. More correct results might be obtained if the burner could be fitted with a chimney possessing less absorptive power, or if the absorption coefficient of a glass chimney for rays of every individual wave length could be determined. Apart, however, from the very laborious character of such an investigation, the conclusions drawn from it would not necessarily be of general applicability, inasmuch as the conditions change when an incan-

descent mantle gets old, and also when it is replaced by a different specimen. The difficulty referred to is less marked in the case of inverted burners, because the glass globe round the burner can be removed for purposes of measurement without greatly interfering with the draught.

The figure quoted in Table I. for the total radiation of an incandescent gas-burner is an estimate made by Lux for an upturned burner inside its chimney, because Wedding also examined his burners duly enclosed in chimneys. In Table II., the value put down for the total radiation between o and $\infty \mu$ of the upturned incandescent gas-burner was 473 watts. This value, as already explained, was deduced by a process of extrapolation and mensuration from the radiations between o and 3 μ, which were found to be equal to 112·1 watts. There is no doubt, however, that the larger figure is incorrect, because although the glass chimney does absorb a considerable proportion of the rays having wave lengths exceeding 2·7 μ, the absorption is not perfect. Approximately correct values for the total radiation of the incandescent gas-burner could doubtless be obtained by using some such process as that proposed by Angström; but as Lux was unable to employ the reflecting spectroscope, he was obliged to restrict himself to absorbing the visible rays in the solution of ferrous ammonium sulphate previously referred to. Starting from the figure for the radiation of light given by the bolometer after all the rays having wave lengths exceeding 0·7 μ had been absorbed in the reagent, he found the total radiation to be equal to 147 watts; whereas the same burner, tested without its chimney by means of the bolometer, gave a value of 141 watts. The agreement between these two results appears to Lux to be so good that he considers 147 watts to be at least a near approach to the true value for the total radiation of the burner.

The complete figures for both an upright and an inverted incandescent gas-burner are recorded in Table V. The upturned burner used was an ordinary Welsbach fitted with a "Cerofirm" mantle made some time before. The inverted burner was constructed by the Deutsche Gasglühlicht Aktien Gesellschaft, and fitted with a "Degea" mantle. The consumption of the upturned burner was 121·5 litres per hour, and of the inverted burner 96·8. Expressed in 10^{-4} watts, the figures relating to these two burners, from which the data quoted in Table V. are deduced, were—

	Upturned Burner.	Inverted Burner.
Total radiation—		
(*a*) With chimney.		
Horizontal radiation	10·65	10·08
Mean spherical radiation	8·92	7 78
(*b*) Without chimney.		
Horizontal radiation	13·4	14·8
Mean spherical radiation	11·2	11·4
Radiation of light—		
Horizontal radiation	0·312	0·299
Mean spherical radiation	0·262	0·231

It must be admitted that the figures in Table V. for the upturned and inverted burners are not thoroughly comparable, as mantles of different manufacture were employed. Nevertheless, it can be clearly seen that the phenomena involved do not differ greatly, and that, from the standpoint of converting energy into light, the inverted burner is no great advance on the upturned burner.

In the course of his investigations upon the behaviour of incandescent gas-burners, Lux carried out a series of tests upon the phenomena of mantles containing different proportions of ceria. Seven different mantles were placed at his disposal by the manufacturers—the first composed of thoria alone, the last composed of ceria only, the others containing increasing proportions of ceria mixed with thoria. All the mantles were tested under precisely identical conditions, at a gas pressure of 44·5 mm. and at a consumption of 144 litres per hour, which was found to be the most advantageous rate for the mantle containing 1 per cent. of ceria. The mantles were tested on a burner inside a chimney; only the light and the total energy emitted in a horizontal direction being measured. The results are shown in Table IV. If

TABLE IV.

Composition of Mantle.	Illuminating Power in Hefners.	Horizontal Radiation per 1 Sq. cm. at 1 Metre Distance 10^{-4} Watts.
Pure thoria	3·3	7 8
1 per cent. of ceria	143·3	10·1
2 ,, ,, ,,	120·5	10·9
3 ,, ,, ,,	105·6	11·6
4 ,, ,, ,,	91·0	12·2
5 ,, ,, ,,	82·9	12·9
Pure ceria	4·0	16·3

the data contained in this table are plotted upon a diagram having abscissæ representing the proportion of ceria present, it will be found that the curve of the illuminating power rises very quickly between o and 0·8 per cent. of ceria to a maximum, afterwards falling more slowly to a second minimum at 100 per cent. of ceria. The curve of the total radiation, on the other hand, rises regularly from a minimum at o per cent. of ceria to a maximum at 100 per cent. The fact that the total radiation curve shows no break at or about the point where the light curve changes its direction, is very noteworthy—meriting special attention in connection with the low energy-equivalent of one spherical hefner in the incandescent gas-mantle. An analogy with this phenomenon has at present only been found in the electric arc.

Direct Current Arc.—Before quoting the actual results of his experiments upon the behaviour of different forms of arc lamps, Lux points out that an investigation of the radiation phenomena in such sources of artificial illumination is much more difficult than even in the case of incandescent gas. While the evolution of light in a flame, in a glow lamp supplied from accumulators, and also to some extent in a glow lamp fed with current from a dynamo, is a continuous phenomenon, the electric arc is discontinuous. The flickering of an alternating current arc can be noticed by the eye, unless the periodicity reaches about 100; and even when such high frequencies are adopted, the vibration becomes evident again when the light is measured by means of a flicker photometer. Light is not evolved continuously from a direct current arc unless the current is derived from an accumulator. Every arc sings more or less; the note it gives depending upon the velocity at which the dynamo runs, the number of the poles, and the number of the commutator segments. Further irregularities arise during the consumption of the carbons owing to want of homogeneity in their composition, and to the manner in which the arc wanders from one point to another.

Carbons have undoubtedly been greatly improved during the last ten years, so that much of its original flickering has been removed from the arc; but nevertheless a steady wandering about the poles seems to be unavoidable. Hence measurements of the total radiation, or the illuminating power, of an arc, are correct only for the moment when they are made. Even if a very large number of readings are taken, the average result may differ by several per cent. from the true value. Again, if measurements are made at every 10° or 5° in one or more meridians, the whole process occupies several hours; and during the period the radiation phenomena may change to a very serious extent. Attempts have at times been made in various laboratories to eliminate the errors, by causing two observers to make simultaneous readings in different directions, or (as is done in Körting and Mathiesen's laboratory) by employing four photometrists. The process, however, introduces fresh sources of uncertainty through the varying personal equations of the photometrists. When it is simply a question of determining the mean spherical illuminating power of an arc, Ulbricht's sphere renders excellent service, as the results it gives are independent of the wandering of the arc; but when the investigator requires to study how the intensity of the light differs in different directions, the sphere cannot be employed. For this, and other reasons, Lux is prepared to admit that the results he has obtained are provisional, though he believes them to be at least comparable in order of magnitude with the figures relating to other illuminants. He hopes at some future date, with the aid of more precise instruments, and by the adoption of modified processes, to deal with the mechanism of arc lamps more thoroughly and satisfactorily; but in the meantime the figures recorded in Table V. are worthy of consideration.

The actual open direct current arc lamp employed in the investigation was a 10-ampere lamp, the upper carbon of which was 18 mm., and the lower one 12 mm. in diameter. The carbons burnt unusually evenly; and they only gave 0·223 gramme of slag during a period of nine hours. The ash was deposited in very fine particles upon the positive carbon, the upper part of the globe, and the lamp fittings. No reduction of illuminating power was observed during the time the lamp was alight. In this connection, Lux points out that, when good carbons are employed, the mean spherical illuminating power of an arc may often increase during the time it is alight. He has made twenty-four sets of measurements with twelve pairs of electrodes, using an arc surrounded by a very thick opal globe. At the beginning of the tests the average mean spherical illumination was equal to 284 hefners; it rose to 286 at the end of the ninth hour. The distribution of the light had changed somewhat; that afforded in all directions between the vertical and angles of about 75 therewith having increased by about 10 per cent., while that between the horizontal and the depending angles of 15° had decreased. The change is probably due to the collection of ash in the upper part of the lamp, which acts as a reflector. When inferior carbons are employed, the light emitted decreases after about 9 or 10 hours, because the whole of the interior of the globe becomes covered with ash. Reverting to Lux's experiment, summarized in Table V., the lamp he employed was examined without any globe. It was run at a mean E.M.F. of 45·5 volts, consuming, on an average, 9·8 amperes. Current was taken from the town supply; an appropriate resistance being inserted in the circuit, and a battery of eight large accumulators being employed to act as an equalizer. The chief practical difficulty experienced in the course of the tests lay in keeping the thermopile, and also the bolometer, properly directed to the centre of the arc. For the purpose of doing so, Lux employed a sighting telescope provided with a level; but he hopes to use some better arrangement in the future. In the photometric work, a secondary standard of light was employed—viz., a nominal 50-candle power tantalum lamp, which actually developed 61 horizontal hefners at 110 volts.

The Enclosed Arc.—The enclosed arc lamp was a 4 ampere, 220 volt lamp fitted with 13 mm. carbons. The arc itself was about 40 mm. long; the light being distinctly violet. It was connected with the town supply through an equalizing battery of 16 volts; the total resistances inserted in the circuit being such that the E.M.F. at the lamp terminals was 217 volts. Behind the resistance belonging to the lamp itself, the E.M.F. was 126·7 volts; and the consumption of current was 4·275 amperes. During its photometric examination, the arc was enclosed in a small

globe of clear glass, which was removed when the total radiation had to be examined. A flicker photometer was used for the photometric work. It is known that the enclosed arc is less economical than the ordinary direct arc; but the extraordinarily low ratio of light emitted to the total radiation, or to the energy consumed, is very striking. The author believes that luminescence phenomena have to do with this, and that the enclosed arc is less of an apparatus for merely converting heat into light than the ordinary arc.

Flame Arc.—The flame arc examined by Lux was a 45-volt, 8-ampere lamp, fitted with cored carbons, 8 and 9 mm. in diameter, which had copper rings deposited on them by electrolytic means in order to increase their conductivity. Measurements were made upon this lamp in the manner already described—firstly, when fitted with carbons for yellow light, and, secondly, when fitted with "extra white" carbons. The tint of the light in the second case was much pleasanter; but, as Table V. shows, the economy suffered greatly. Nevertheless, it was still much greater than that of any other lamp of the kind.

The Alternating Current Arc.—The alternating current arc tested by Lux was an 8-ampere, 28-volt lamp fitted with cored carbons 10 and 11 mm. in diameter. It was supplied with current from a laboratory alternator driven by a 5-H.P. electric motor. The alternator was provided with six collector rings; so that it would yield either mono, di, or tri phase current. At the ordinary rate of revolution, the periodicity of the current was 50. Unfortunately, it was not possible to obtain a higher E.M.F. at the connections of the lamp than 25 volts; and since an alternating arc of only 8 amperes running at so low a tension is recognized to be unusually lacking in economy, no surprise need be felt at the badness of the author's results. The figures must therefore be regarded as provisional; but Dr. Lux hopes to carry out some measurements with a larger lamp on future occasions.

Other Lights.—On referring to Table V, it will be observed that several sources of light are mentioned there which have not been described in the text. In some cases, no details respecting them appear in the pamphlet that we have been abstracting. It may, however, be explained that the paraffin lamp consumed 39·73 grammes of oil per hour, having a heat of combustion equal to 11,050 Calories. The total radiation was measured after the removal of the chimney. The acetylene flame was an open one, consuming 7·2 litres per hour; the heat of combustion being 13,900 Calories. The Uviol lamp was about 90 cm. long, taking on an average 3·3 amperes of current at a mean E.M.F. of 63. Dr. Lux suggests that the low value for the total radiation in comparison with the energy absorbed by the Uviol lamp may be largely explained by the consumption involved in keeping the mercury in a state of vapour.

TABLE V.

Source of Light.	Energy Consumed.	Spherical Radiation. Total.	Spherical Radiation. Light.	Ratio of Light to Total Radiation.	Ratio of Light to Energy Consumed.	Horizontal Illuminating Power.	Mean Spherical Illuminating Power.	Specific Consumption per Spherical Hefner in Watts.	Energy Equivalent of one Spherical Hefner in Watts.
	Watts.	Watts.	Watts.	Per Cent.	Per Cent.	Hefners.	Hefners.		
Hefner lamp	86·3	9·96	0·089	0·89	0·103	1·0	0 825	104·6	0·108
14-inch paraffin lamp	508·0	102·20	1·26	1·23	0·25	14·2	12·0	42·3	0·105
Acetylene flame	96·0	9·78	0·62	6·36	0·65	7·7	6·04	15·9	0·103
Incandescent gas—(*a*) upright:									
Without chimney	716·7	147·0	3·28	2·26	0·46	107·0	89·6	7·98	0·037
With chimney		112·1		2·92					
Incandescent gas—(*b*) inverted:									
Without glass	571·0	143·0	2·9	2·03	0·51	107·0	82·3	6·97	0·035
With glass		97·6		2·97					
Carbon filament glow lamp with bulb	98·23	63·5	2·03	3·2	2·07	31·5	24·5	4·09	0·085
,, ,, ,, without bulb		75·2		2·7					
Nernst lamp without series resistance.	165·0	122·2	6·96	5·7	4·21	120·1	94·9	1·74	0·073
,, ,, with series resistance.	181·4				3·85			1·91	
Tantalum lamp	44·0	25·2	2·15	8·5	4·87	34·6	26 7	1·65	0·080
Osram lamp	38·3	22·5	2 05	9·1	5·36	36·3	27·4	1·43	0·075
Direct current arc lamp	435·0	301·8	24·3	8·1	5·60	190	524	0·83	0·047
,, ,, ,, enclosed	541·0	308·0	6·2	2·0	1·16	200	295	1·31	0·021
Flame arc, yellow light	349·7	295·0	46·2	15·7	13·20	907	1145	0·31	0·041
,, ,, white light	348·0	304·5	23·2	7·6	6·66	602	760	0·46	0·031
Alternating current arc	180·6	91·2	3·4	3·7	1·90	109	89	2·03	0·038
Uviol mercury vapour lamp	198·6	91·3	5·3	5·8	2·24	437	344	0·58	0·015
Quartz lamp	691·0	236·0	41·5	17·6	6·00	3400	2960	0·23	0·014

General Conclusions.

The author sums up the conclusions at which he has arrived in somewhat the following manner: The sources of light investigated and dealt with in Table V. may be divided into four groups. The first consists of the hefner lamp, the upright and inverted gas-burner, the paraffin lamp, and the acetylene light, and is distinguished by the presence of an open flame; the second group is composed of the different electric glow lamps; the third is made up of electric arcs; and the fourth comprises the mercury vapour lamp, which in various respects stands alone. The first point to be observed in considering the economy of a source of light is the relationship between the luminous rays emitted and the amount of energy expended. In studying this feature, it is necessary to base conclusions upon the total light emitted in all directions, because the distribution of the light rays, though very important from a practical aspect, has nothing to do with the inherent efficiency of the light source. Different figures are obtained for the efficiency of any particular unit according as the light afforded is defined as the total of the rays having wave lengths lying between 0·4 and 0·8 μ, or as the light which can be measured by the photometer. Nevertheless, the arrangement of the different light sources in their order of increasing efficiency, as shown by Table V., is not greatly altered by adopting one or other of the above definitions for "light." Employing a purely physical definition, a better judgment is obtained as to the progress made in the evolution of light; but an evaluation of luminous sources by the photometer renders the conclusions more in keeping with the requirements of everyday practice.

If the light sources are regarded solely according to the light they evolve for a given impress of energy, it will be manifest that flame illuminants are extraordinarily inefficient. The worst are those in which the luminous body is incandescent carbon. When the radiant is composed of some other substance, such as the material of a Welsbach mantle, the economy is better; the ratio of light emitted to energy consumed rising to double its former value. It must, however, be remembered that the mechanical efficiency of the upturned or inverted incandescent gas-burner is still disgracefully low. The fundamental defect of the incandescent gas-burner is that the mantle is raised to incandescence by a flame out of all proportion in size to the mantle itself. The heat of the flame would raise the mantle to a much higher temperature, and would therefore increase its illuminating power in a far higher ratio, if only it were possible for the entire heat developed to be impressed upon the mantle.

This is imposible with the present incandescent burner, for the mixing of the air with the gas is imperfect. The combustion proceeds over a comparatively large space, and therefore at a low speed; while the greater part of the heat actually evolved is consumed in raising the temperature of the atmospheric nitrogen. The results obtained with the Lucas burner, and more particularly with the Selas burner, show how the yield of light can be increased by rendering the mixture of air and gas more homogeneous; but even in these burners the volume of the flame is enormously greater than that of the mantle. Indeed, these sources of light are properly regarded as being primarily or essentially sources of heat; for evidently no radical change underlies an increase from $\frac{1}{2}$ per cent. to about 1 per cent. in the ratio between light afforded and energy consumed. Much greater economy would be attained were it possible to burn the gas in an atmosphere of pure oxygen, as some two-thirds of the present loss of heat would be thereby avoided. Still, an incandescent gaslight, burning gas in oxygen, only exhibits a degree of efficiency having the same order of magnitude as that of the ordinary carbon filament glow lamp. Undoubtedly such an advance would be of great value from a practical point of view; but theoretically the improvement would not be large.

The ideal system of evolving light is obviously one wholly dissociated from the production of heat. Heat is primarily produced by an acceleration of molecular velocities, and only indirectly involves an acceleration in the velocities of the electrons which we denominate "light." Even when the heating effect of the electric current is employed to raise the temperature of a luminiferous object, the production of light is still a roundabout process. But, on the other hand, with the aid of current, it is at least theoretically possible, by mere increase in temperature, to render the ratio of light to total energy far more favourable. The truth of what has just been stated is clearly demonstrated by the figures in the first two sections of Table V. A

considerable increase in the temperature of the radiants would certainly shift the maximum of the total radiation into the visible region; but even if the whole of the energy radiated were composed of rays between 0·4μ and 0·8μ in length, the ratio of light emitted to energy impressed would only reach some 20 per cent. in the very best cases. Indeed, not unless the temperature could be urged to an extraordinary point—a point lying, according to the ordinary radiation equation, at about 5500° or 5800° on the absolute scale—so that the maximum of the radiation should lie in the yellow-green part of the spectrum; nor unless the heating of the atmospheric nitrogen could be avoided, and a perfect radiant body be discovered, could an ideal degree of economy be obtained in a flame illuminant.

The figures relating to the various incandescent electric lamps in the table show that a very reasonable proportion of the energy expended is recovered in the form of total radiations. The losses in the case of the tantalum and osram lamps appear somewhat larger, but only because Lux was not able to make proper allowance for the rays absorbed by the globes of these lamps. If it be assumed that the loss brought about in this manner is essentially the same as in the case of the carbon filament lamp—*i.e.*, about 15·5 per cent.—it appears that some three-quarters of the total energy impressed is returned in a radiant form. An increase in the temperature of the radiants would not change this proportion, but would only increase the proportion of visible rays in the total radiation. So that, from the point of view of light production, an efficiency of 60 per cent. and upwards might be obtained. The increase in efficiency due to increased temperature is well shown by the metallic filament lamps, whose higher duties are principally due to the higher temperatures of the filaments. The same fact is shown more clearly by experiments with over-driven carbon filament lamps. A normally driven 16-candle power carbon filament lamp absorbs about 3·5 watts per hefner; but if the energy impressed upon it is gradually raised, it will, at the moment when the filament ruptures, develop some 2000 hefners for a consumption in electrical energy of only about 0·13 watt per hefner. Thus, just before it breaks down, the carbon filament converts more than 56 per cent. of the energy expended upon it into light by a process of simple heating.

The task before the lighting engineer is therefore to discover some material which will bear an impress of energy for an indefinite period of time equal to that which the carbon filament of to-day will only bear for a few seconds. Lux does not consider that the problem so set forth can be solved with the aid of any metallic filaments; for even the most refractory metal has a melting point which imposes a limit on the temperature to which it can be submitted. He is inclined to believe that carbon prepared in some absolutely homogeneous form, and perfectly free from occluded gases, is likely to prove a more efficient material for the construction of a filament than any metal. At the same time, owing to the process being indirect, it should always prove rather more difficult to increase the efficiency of such sources of light as are dependent on temperature alone than to set the electrons in motion by the direct production of appropriate vibrations. A much higher degree of efficiency has indeed already been reached from light units that do depend in large measure upon luminescence phenomena. The most conspicuous instance of this is the mercury vapour lamp, after which come those arc lamps where gases or metallic vapours are brought to incandescence. The arc lamp with enclosed arc and the alternating current arc taking small quantities of current, have much lower efficiencies—scarcely exceeding that of the electric glow lamps; so that attempts to improve the former seem useless. Reference to Table V. will show that the efficiency (in terms of energy consumed) of an ordinary paraffin lamp, which is still by far the most generally adopted illuminant, is only 0·25 per cent.; whereas the yellow flame arc lamp has an efficiency of 13 per cent.—*i.e.*, is 52 times as efficient. Certainly an arc lamp yielding about 1100 spherical hefners is not at all suited to domestic employment; but if it were possible to produce a similar piece of apparatus developing only about 100 hefners, and yet exhibiting the efficiency of the present flame arc, a greater advance would be made than has hitherto been signalized in the realm of illuminating engineering.

It does not seem to Lux that any obstacle of a theoretical nature stands in the way, although the practical difficulties are doubtless very great. It is, however, well to realize that the means at the disposal of the engineer of to-day enable him to convert energy into light with the same degree of completeness as that with which one form of energy is converted into another in the steam-engine. Up to the present time, attempts to develop artificial light by means of luminescence phenomena have led to far better results than those that have ever been obtained in the conversion of heat into light. For this reason, particular interest attaches to the values given in the table for the mechanical equivalent of light. Lux's experiments appear to show that the view expressed in much contemporary technical literature, according to which the mechanical equivalent of light is a constant, can no longer be maintained. It is manifest that the precise mechanical equivalent must depend on the composition of the light. Variations in the composition account for the differences in the size of the equivalent when light sources of similar nature are under consideration; but the figures in the last column of the table bring another point into prominence. Those sources of light in which the incandescent body is finely divided carbon, and also the ordinary electric glow lamps, exhibit an energy-equivalent approximately equal to 0·1 watt per mean spherical hefner. These are the light sources that depend simply upon temperature. In the case of arc lamps, the average energy-equivalent is about 0·04 watt per mean spherical hefner; while the mercury vapour lamp that gives a pure line spectrum has an equivalent of only about 0·014 watt per mean spherical hefner. Thus it may be said that the sources of light whose visible rays are partly due to luminescence absorb less than half the energy that other sources do that depend simply upon temperature. This view seems to be plausible enough when the mechanism of light production is explained according to the theory of electrons. From this standpoint the phenomena of the Welsbach mantle are of peculiar importance, inasmuch as the energy-equivalent of the incandescent gas-light stands at the same level as that of electric arcs. The specific composition of the mantle evidently enables it by simple heating to develop vibrations of the electrons to a degree which is otherwise only possible under the influence of electricity. The fact, however, that the mantle possesses a marked power of selective radiation is not sufficient to explain the low value that it exhibits for the energy-equivalent of the light.

A VISIT TO MESSRS. ALEX. WRIGHT AND CO.

By the Association of Engineers-in-Charge.

Amid an almost bewildering assortment of modern instruments for testing, indicating, recording, and other purposes, those members of the Association of Engineers-in-Charge who were desirous of making closer acquaintance with such things spent last Saturday afternoon, when a party of between fifty and sixty of them paid a visit to the premises of Messrs. Alexander Wright and Co., Limited, at Westminster Palace Gardens, Artillery Row, Victoria Street, S.W. The show-rooms in which they found themselves are excellent ones, and the display of the particular forms of apparatus with which the firm are associated was complete; but it is to be feared that if they had been obliged to content themselves merely with looking at what was on view, many of the visitors would have left the place little wiser than when they entered it. Speculation on this head is, however, unnecessary, inasmuch as the party did not have to rest content with a cursory examination of the various appliances. On the contrary, Mr. Jacques Abady and a number of members of the staff proved indefatigable in explaining everything there was to explain; and it could only have been a very clever person or a very stupid one who did not add something to his store of knowledge during the couple of hours or so that were spent under such capable guides and demonstrators.

With regard to just what there was to be seen, it is not necessary to say very much here; for it was only about eighteen months ago—somewhere about the time when the show-rooms were opened—that a lengthy description, together with numerous illustrations, of Messrs. Wright and Co.'s specialities appeared in the pages of the "JOURNAL" (see the issue for Oct. 9, 1906, p. 97). Mr. Abady, in welcoming the visitors, explained that there were three or four appliances which they wished to show in actual working, and which required a manipulator to make the demonstration. There was the CO_2 recorder, and the method of testing gas (for such cases as producer plants) for its heating power. Then a chemist would show them how tests were made of the heating power of coal; and there were photometers for indicating the candle power of both gas and electric lights. The members then split themselves up into groups in different portions of the show-rooms.

The description by Mr. Abady of the working of the CO_2 recorder was eagerly listened to, and the operation of the instrument was carefully followed. It is an apparatus to which the firm are devoting a large amount of attention; and it is also one in which most of the members of the Association are no doubt particularly interested—and especially so perhaps since their President, Mr. W. H. Patchell, some months ago in his Inaugural Address laid stress upon the need for carefully recording the percentage of carbonic acid in flue gases—pointing out that it was a custom in many German works to pay stokers a premium on the amount of carbonic acid recorded, a plan which was found to have beneficial results. Messrs. Wright and Co.'s apparatus for this purpose—named the "Co_2mbustion" recorder—is attached to boiler flues for the purpose of obtaining an automatic analysis of the furnace gases, so as to show the percentage of carbonic acid there is in these gases. Whether it is a case of too much or too little air, both show themselves in the percentage of carbonic acid. Mr. Abady pointed out to the members that though, of course, the idea of taking such tests is not novel, the apparatus made under the Simmance-Abady patent furnishes an automatic analysis from the boiler flues hour by hour, and requires practically no attention; and the stoker can do just what he pleases, so long as he sees that he is getting a high percentage of carbonic acid.

Another instrument to which the visitors devoted a good deal of their time was the Roland Wild calorimeter for estimating the heating value of solid fuels, practical demonstrations with which were given by Mr. E. E. Grimwood. In this, a stated quantity of the dried fuel to be tested is mixed with a proper amount of sodium peroxide in a crucible, which is then closed and placed in a vessel containing a known quantity of water. The mixture

is afterwards fired by means of a red-hot nickel wire introduced through a conduit in the top of the crucible. The rise in temperature of the water enables the calorific value in B.Th.U.'s of the fuel and its evaporative power per pound to be calculated. Near by was also to be seen the Simmance-Abady patent standard gas calorimeter, for testing gases of all descriptions. Among the various photometers, the form at present employed for the gas in London, the firm's well-known "Flicker" pattern, the portable arrangement for testing arc lamps, &c., and the steel tube type (to which was attached an electric lamp spinner, which renders it possible to value a glow lamp by one observation), all claimed their share of attention. In addition to the instruments mentioned here, there were, of course, numberless others over which the visitors pored—thermometers, registers, draught gauges, pyrometers, standard measures, &c.

At the conclusion of the inspection, the visitors took tea with Mr. J. F. Simmance and Mr. Abady, after which Mr. Arthur Davey (the Chairman of the Association) proposed, and Mr. A. E. Penn (the Vice-Chairman) seconded, a hearty vote of thanks to these gentlemen and the staff for all the attentions received at their hands. Mr. Abady, in acknowledging the compliment, remarked that both Mr. Simmance and himself took a very great interest in everything appertaining to the application of science to manufacturing processes. They were very keen nationalists in the sense that they wanted everything that possibly could be produced in this country to be so produced; and, of course, they also had a material interest in this matter. They did not, however, allow the latter consideration to be first and foremost with them; for, as he had said, they did really take a great interest in everything that tended towards progress. They were gratified that so many members of the Association had taken part in the visit that afternoon.

De Brouwer Machinery at Derby and Bristol.

We are informed that the Directors of the Derby Gaslight and Coke Company, acting under the advice of their Engineer (Mr. J. Ferguson Bell, M.Inst.C.E.), have placed with Messrs. W. J. Jenkins and Co., Limited, of Retford, an order for a fourth installation of De Brouwer stoking machinery, coal and coke handling plants, and retort-bench fittings. It will be remembered that the Derby Company were the first in this country to work the system, and the results given by Mr. Ferguson Bell to the Midland Junior Gas Association (see "JOURNAL," April 14, p. 99)—viz., 7¾d. per ton at the Cavendish Street works, and 9½d. per ton at the Litchurch works, inclusive of all charges from coal in carts and railway waggons to coke on the heap in the yard or in overhead hoppers—seem fully to warrant the choice of the system. The Bristol Gas Company have also decided, after three years' experience with the "D.B." machinery at their Stapleton works, to instal a "Jenkins De Brouwer" complete stoker at the Canons' Marsh works, where two retort-houses have already been fitted with Fiddes-Aldridge machines.

Coke v. Coal for Steam-Raising at Ryde.

The Ryde Town Council have been much exercised of late over the question of the use of coke or coal for raising steam. The Water Committee some weeks ago considered the question of the comparative values of the two fuels, together with figures submitted by the Resident Engineer at the water-works (Mr. J. Harvey), and recommended that the tender of the Ryde Gas Company for 150 tons of coke, to be delivered at Ashey at 19s. 2d. per ton, and at Knighton at 19s. 6d. per ton, for three months, should be accepted. The recommendation was not adopted—the voting being even—and it was referred back to the Committee. It was recently brought up again at a special meeting, and was the subject of a long and, at times, rather heated debate. It happened that the Chairman of the Water Committee was connected with the Gas Company; and this seemed to inspire some members with a certain amount of distrust. In the result, the recommendation was rejected. Thereupon a proposal was submitted to the effect that 133½ tons of Nixon's Navigation coal should be purchased, at 35s. 9d. per ton; but the voting upon it was equal. The Mayor (Alderman G. E. Mears), who is a Director of the Gas Company, did not give a casting vote, and the meeting closed without a decision being come to.

Dukinfield Gas Department.

The Manager of the Dukinfield Corporation Gas Department (Mr. William Lindley) reports that the carbonizing plant worked satisfactorily during the past financial year; the yield of gas per ton of coal having been 11,456 cubic feet. There was a decrease of 3 million cubic feet in the make of gas, accounted for by the reduced leakage; while the sales showed an increase of 750,000 cubic feet, compared with the year 1906-7. The total quantity of gas accounted for was 85,363,700 cubic feet, apportioned as follows: Cottages, by ordinary meters, 42,137,300 cubic feet; do., slot-meter consumers, 9,300,700 cubic feet; mills, 26,920,604 cubic feet; public lamps, 5,928,371 cubic feet; offices, works, &c., 1,076,725. The total revenue for the year was £14,622 (£11,359 being for gas), and the expenditure £10,818 (£5386 being for coal); leaving a gross profit of £3804. Adding £26 received as cottage rents, a total of £3830 was produced. Of this sum, £3278 was required for annuities, interest, and sinking fund; leaving a net profit of £552, compared with a loss of £242 for the year 1906-7. According to a table, which has been verified by Mr. W. Moss, of Ashton-under-Lyne, showing the cost of gas per 1000 cubic feet sold for the past and the preceding financial year, the total cost of production in the former was 2s. 6·38d., and in the latter 2s. 6·61d.; the average prices being 2s. 7·93d. and 2s. 5·92d. There was consequently a gain of 1·55d. in 1907-8, against a loss of 0·69d. in 1906-7, upon which Mr. Lindley is to be congratulated.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Right and Left Hand Valves.

SIR,—We lately ordered from a well-known maker some 12-inch and 24-inch gas-valves. When they were delivered, to my great surprise, I found they were left-handed instead of right-handed—that is to say, they opened "against the sun" instead of "with the sun."

I remember when a boy that whenever we had a "blow" with a seal-cup or purifier-lute, almost the first thing to remember was whether the valve was a left-handed one or a right-handed one—as both were used indiscriminately, and in something like the same proportion.

I cannot believe any modern gas undertakings would now tolerate a mixture of right-handed and left-handed valves to form part of their plant; but in case the point may not have occurred to all your readers, I venture to trouble you with this letter.

CHARLES CARPENTER.

South Metropolitan Gas Company,
May 9, 1908.

Prepayment Meter Robberies.

SIR,—In my opinion there are reasons, which are fairly obvious, why the less said about these robberies the better. It may be remarked, then, why say more; but I am led to depart from this view by the fact that, as a means to an end, the question of a rebate or discount is now in the air, and so I offer a few remarks which may help to prove its efficacy in this direction.

It was adopted some eight years ago by the company with which I am connected, in order to meet a general reduction in the price of gas, rather than by the really unsatisfactory method of altering the meters. The allowance (which is so much per 1000 cubic feet, and is given at each collection) has been increased from time to time as the price of gas has gone down—with this result, that we find consumers do take a very great interest in the matter, and are careful to send timely notice when removing, in order to receive what is due to them. When we get this notice, we do the rest.

Facts are stubborn things; and the following shows the result of prompt collection from empty houses. The consumers' meters number 16,000, and are collected monthly; and the number of changes are considerable. In 1907, over £40,000 was collected, and robberies in the year amounted to £32, which is equal to 0·08 per cent., or, divided over the consumers, about ½d. each.

To endeavour to preserve the meter from damage (and, in my opinion, the more flimsy the construction the better, as the damage to the meter is not so great, nor so fraught with danger of escapes of gas), a notice is suspended by the collector over the money-box in an empty house, stating in prominent letters that the "Money has been taken." This at once tells the would-be thief that investigation here is unprofitable. The notice also gives information for the next tenant's guidance. This is working so far satisfactorily.

The more the matter of a rebate is considered, the more desirable it appears; and in one direction alone it promotes a certain amenity in the dealings of collector and customer. Any objections I have heard are of a pedantic nature, and lack the simplicity which should especially be aimed at in this class of business.

At any rate, I should be very sorry to see the price of gas so increased that it wiped out the rebate.

C. W. B.

May 8, 1908.

Sulphate Saturators.

SIR,—Referring to Mr. Williams's letter in your issue of the 5th inst., Mr. Williams says: "The steam and gas admission passages constituted by the perforations are limited by the thickness of the wall of the pipe or saturator. The said passages rapidly become enlarged, with the result that the steam and gases become unequally distributed." In practice, the wall of the pipe or saturator is made sufficiently thick that the perforations do not become materially enlarged in cross sectional area. Consequently a practically equal pressure of steam at each orifice is maintained; and so there is equal agitation of the acid liquor. Seeing that my patent does exactly what Messrs. Williams and Fenner claim to do, in practically a similar manner, my charge of infringement is perfectly justified.

GEO. PETTIGREW.

Thornaby, May 9, 1908.

The Nuneaton Gas Company and its Affairs.

SIR,—As President of the Society of British Gas Industries, I feel constrained to take notice of the extraordinary letter in this week's "JOURNAL" from Mr. George Helps, objecting to manufacturers of gas apparatus being shareholders in gas companies.

The objection is utterly untenable. Any person and every person who has money to invest has the right, with which no man has any right or power to interfere, to invest his money in any public company. Of course, if a trader supplying goods to a company becomes a director (which he may do), he must cease to do business with the company.

For my part, I am glad to see that traders show their confidence in a company by becoming shareholders. It gives them no power whatever to influence business, and can do no harm, but is, as it seems to me, beneficial. It is a totally different matter for directors or managers of public companies to take shares, or to have a pecuniary interest, in undertakings doing business with their company. Against this Mr. Helps may be quoted: "and I call upon every man who loves truth and uprightness, honour and integrity, to make a stand against such practice," &c.

GEORGE LIVESEY.

Shagbrook, Reigate, May 8, 1908.

SIR,—In your last issue, I notice that Mr. Helps, in his letter *re* the above, introduces me as having something to do with the calling of a special meeting of shareholders in the Company. I am quite ready to admit that I share the responsibility with others who are not satisfied

with matters as they now stand, and think we are fully justified in entering our protest. We did not expect to carry our resolution; but it has brought the question to the front. There are various reasons why some shareholders do not care to vote, but are yet in full sympathy with those who are not content to let things remain as they are. If the other shareholders are content, I think they are easily satisfied.

Mr. Helps's bounce and bombast have no effect on me. I placed my value on that long ago.

Now, Sir, I should like to say that, personally, I have not the slightest objection to Mr. Helps being well paid, and that he be allowed to do a reasonable amount of outside work; but I do think that the shareholders have a right to expect him to consider that his first duty is to see that the interests of the Nuneaton Gas Company do not suffer. Reduced dividends for three consecutive half years, along with a considerable reduction in the market value of the Company's shares, and then to wind up with an advance in the price of gas, does not give me the impression that this is so.

I cannot see any valid reason why the Nuneaton Gas-Works should not pay as well as other gas-works in the Midlands, if properly managed. I do not anticipate that many of us will be much alarmed by Mr. Helps's fiery letters, with his cant phrases and vivid appeal to all lovers of truth, uprightness, honour, and integrity. Let him remove the cause of complaint.

I attended a meeting of the shareholders some time ago, and there expressed my opinion freely; and I am hoping to have another opportunity, so that I may ask a few rather pointed questions.

However, I trust some good may come out of this agitation, and that future balance-sheets may show a better state of things. We are not asking for impossibilities.

At the meeting to which I refer above, the Chairman was proceeding with the business when I politely reminded him that the minutes of the last meeting of shareholders had not been read. He replied that it was not necessary. I think I said it was customary. He then absolutely refused to have them read; and I believe I am correct in saying that a Mr. Phillips (who I think is now a Director) stated at the recent meeting that meetings were illegal if the previous minutes were not read, &c. I do not know whether this is so or not; but I do know that the impression it left on my mind was that there was something it was not convenient for the meeting to hear.

The Ecliptic Gas-Fittings Company and its connection with the Gas Company may be heard more of later.

WM. NORTH.

Torquay Road, Paignton, May 8, 1908.

SIR,—I do not propose to say more than a few words in reference to the Nuneaton Gas Affairs; neither shall I follow the mazes of Mr. Helps's letter and speeches; nor am I to be drawn aside by "red herrings."

I feel bound, however, to say that the remark by Mr. Helps, that I "brought about this agitation with the express purpose of getting on the Board" is devoid of truth. During the last ordinary shareholders' meeting, I did consent to "sit" if elected, although for weeks previously I had refused, on the ground that I should be in an isolated position. The shareholder who proposed me held 100 shares. I was beaten by a narrow majority; my own vote not being used. I very much prefer that the men who have allowed the Company's affairs to drift, should remain and enjoy the responsibility. In any case, the presence of Mr. Swinnerton, a Director of long-standing, and Mr. Phillips, who was co-opted last year, and is father-in-law to Mr. Helps, is desirable—they being business men of large experience.

In my opinion there has been unnecessary publicity—first, by obviously inspired articles in the Press, prejudging the case; and, secondly, by flooding the country with reports of the recent extraordinary meeting. Yet, even this may be a blessing in disguise, inasmuch as engineers and managers of undertakings from 80 millions down to (say) 20 millions per annum will when they compare their own results, shake hands with themselves.

I shall not discuss the "Trading Question." It has too many sides. I will, however, simply remark that, if I did, I might be tempted to drive home a remark that was made by a shareholder, and reported in the "Nuneaton Observer," having reference to some of the Directors, and to which no reply was given.

FRED. J. NORTH.

Holly Lodge, Stourbridge, May 9, 1908.

Delegates to the Annual Meeting of the Institution of Gas Engineers.—At the meeting of the Halifax Town Council last Wednesday, Alderman Morley moved the deletion of a minute of the Gas Committee appointing delegates to the annual meeting of the Institution of Gas Engineers next month. He explained that his main reason for making the proposal was that the Institution had spent its money, coming from Halifax and other municipalities, and had used its organization and influence, in opposition to the Coal Mines (Eight Hours) Bill. If the Council did its duty to the ratepayers, it would dissociate itself from the Institution. There was no seconder to the amendment, which therefore fell to the ground.

The Progress of Coalite.—The Directors of Coalite Limited have issued to the shareholders a circular (dealt with in our editorial columns) in which they point out that the Syndicate was formed for the purpose of acquiring from the inventor, Mr. Thomas Parker, the patent rights of the Coalite process. To obtain the patents in the principal countries has been a work requiring time; but the Directors now announce that letters patent in respect of the process have been granted in Great Britain, Germany, the United States of America, France, Belgium, Denmark, and 25 other places. Several other patents relating to important matters of construction have also been granted in the principal countries, to which the greatest value is attached by the Directors. The patent rights for the United Kingdom were last year sold to the British Coalite Company, who have since erected new and larger works at Wednesfield, near Wolverhampton (the centre of a large coal-producing district) for the manufacture of Coalite and bye-products. Extensive works are under construction by the Company at Barking, "to meet the increasing demand for the fuel in the Metropolitan area."

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Blaydon and Ryton Water (Transfer) Bill, Draycott Gas Bill, Gosport Gas Bill, Leicester Corporation Bill, Margate Corporation Bill, Swinton and Mexborough Gas Bill.

Bills read a second time and committed: Bromley and Crays Gas Bill, Bury and District Joint Water Board Bill, Dartford Gas Bill, Lincoln Corporation Bill, Rochdale Corporation Bill.

Bills read the third time and passed: Bognor Gaslight and Coke Company Bill, Derby Gas Bill, Swansea Valley Gas Bill.

The Gas Orders Confirmation Bill (to confirm Provisional Orders relating to Caldicot, Rainford, Rothwell, Tenterden, and Woolmer) and the Gas and Water Orders Confirmation Bill (to confirm Provisional Orders relating to Earby and Thornton Gas, East Hull Gas, and Brough, Burgess Hill, Sevenoaks, and Stourbridge Water) have been presented, read the first time, and referred to the Examiners.

Petitions against the Lincoln Corporation Bill have been presented by the East Retford and Mansfield Corporations, the Nottinghamshire County Council, and the Urban District Councils of Kirkby-in-Ashfield, Mansfield Woodhouse, Sutton-in-Ashfield, and Warsop.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Bognor Gaslight and Coke Company Bill, Swansea Valley Gas Bill.

Bill read a second time and committed: Skegness Urban District Council Bill [Lords].

Bill reported, with amendments: Camborne Water Bill.

Bills read the third time and passed: Manchester Corporation Bill, Margate Corporation Bill, Swinton and Mexborough Gas Bill.

The Llanelly Gas Bill [Lords], South-West Suburban Water Bill, and Pontypridd Water Bill [Lords] have been referred to a Select Committee, consisting of Mr. T. W. Nussey (Chairman), Mr. Waterlow, Mr. Du Cros, and Mr. Nicholls; to meet next Thursday.

PADIHAM URBAN DISTRICT COUNCIL BILL.

Police and Sanitary Committee of the House of Commons.

(*Mr.* CORRIE GRANT, *Chairman.*)

The Committee resumed the consideration of this Bill on Monday last week, when Mr. WEDDERBURN, K.C., with Mr. F. N. KEEN, appeared for the District Council, and Mr. BOYCE represented the Local Government Board.

Part II. of the Bill, which relates entirely to the proposals in regard to gas supply, had already been dealt with, and the clauses, with one or two exceptions, when points were held over for further consideration, passed (see *ante*, p. 300).

Mr. WEDDERBURN said he proposed to deal with the water clauses, which comprised Part III. of the Bill; leaving for the present the discussion on the gas clauses standing over. The position as regards the water supply was precisely similar to that of the gas. Originaly a Company owned the water-works, and they were transferred to the Local Authority by Act of Parliament in 1874; the Authority paying off the Company's debts, and purchasing the property by means of perpetual annuities to the amount of £993 per annum—about 28 years' purchase. By clause 26 of the Bill, they proposed to extend the limits of supply to Simonstone. They already supplied 26 houses, with 108 people, near the railway station, though they had no power to do so. The population of the place, which was chiefly agricultural, was 491; and in order to carry out the extension, it was proposed to purchase the mains of the Burnley Rural District Council.

Mr. *J. C. Waddington*, the Clerk to the Padiham District Council, bore out Counsel's statement as to the facts, and added that the scheme was approved by all parties concerned. In reply to the Chairman, he said the Council would take over the branch pipes from the main crossing Simonstone at a cost of £325.

The CHAIRMAN asked if the revenue from the present water supply provided a fair return upon the capital expenditure.

Witness replied that it did not. The District Council were bound to supply in bulk to the Rural Council for twenty years from 1901.

The CHAIRMAN remarked that clause 26 was not qualified in any way. The Rural Council had not done anything to supply Simonstone, and legally they were not there now. There was a question as to Simonstone being added to the area of supply; and the point was whether the clause as it stood would effectually do this. What the Committee felt was that Padiham should have an exclusive right, and that Burnley should be excluded for the future. Against this, Burnley might have some argument; but, personally, he had no reluctance to dealing with the matter at once.

Witness said he did not anticipate any difficulty with the Rural Council.

After some further discussion,

The CHAIRMAN announced that the Committee were unanimously of opinion that the promoters ought to have the exclusive right to supply Simonstone; and if the clause did not carry this out effectively, it should be made to do so.

Evidence was then given to show that all parties concerned were agreed that Padiham should supply the water.

Mr. *J. Gregson*, the Council's Water Engineer and Manager, was called, and said that the storage capacity of the water-works was 121 million gallons. He put in figures relating to the daily consumption, from which it appeared that the storage capacity was about equal to a year's supply.

Clauses 26 and 27 were ordered to stand part of the Bill; and with regard to clause 28, it was agreed that the words "annual value" should mean the gross estimated rental of the premises supplied, according to the valuation list.

On clause 29, relating to the supply of water for other than domestic purposes,

Mr. WEDDERBURN pointed out that if any reduction in the charge were made, it would increase the rate-in-aid. Under these circumstances, therefore, the Council proposed that the maximum should be 2s. per 1000 gallons.

The CHAIRMAN remarked that the Local Government Board's maximum was 1s.

Mr. KEEN said it was not unusual to fix a higher maximum. Indeed, he had known it to be even 3s. There was no maximum fixed by law. It was a matter for agreement with the consumers.

The CHAIRMAN said the object of the Committee was to get a uniform practice; and he held over their decision on this point.

The other clauses of the Bill, relating to street improvement and general matters, having been dealt with, the consideration of the financial section and the reserved gas clauses was postponed.

On Tuesday, the Committee took up the financial clauses of the Bill, first dealing with those which related to the proposed expenditure upon the extension of the gas-mains to Simonstone, Read, and Sabden. It was stated that the immediate expenditure proposed for the extension of the gas-works would give a production of 100 million cubic feet a year, and that a further expenditure of £10,000 would give them another 80 millions a year.

Mr. *Whitehead* was called, and stated that the Local Authority first came into possession of the gas-works in 1876, when they took them over from the Company.

The CHAIRMAN: Since that time has there been a profit on the gas every year?

Witness: Chiefly. On the whole time, there has been a profit; and it has been carried to the district fund. Since 1896 there has been a profit every year.

Mr. *A. J. Harrison*, the Gas Engineer, was recalled and questioned by the Chairman as to the amount and value of the residual products. He said that there ought not to be much variation in the yield of tar per ton of coal; but a difference had taken place owing to the improved system of carbonization. They got more gas and less tar.

The CHAIRMAN: As a gas engineer, what is your view as to the policy which the Council ought to take up with regard to the price of gas?

Witness said that, personally, he was in favour of a low price for gas. He thought the consumption per head in Padiham was very low, and if a reduction in price took place it would increase. Where electric or other light was used, he did not think it fair that those who took it should benefit by the profit made on the gas. It was desirable in the case of gas to have a considerable margin of revenue in order to meet contingencies. The excess of revenue formed a reserve for the gas undertaking.

By the COMMITTEE: The net cost of the gas into the holder was about 11d. Then there was the cost of distribution and maintenance of works, which brought to 2s. the cost at the consumers' meters. The building of the new works would enable them to make more gas than they did now.

By Mr. KEEN: The estimates provided liberally for all expenditure likely to be incurred.

The gas clauses were then passed; and the Committee proceeded to deal with other matters, including the question of borrowing money to buy up the annuities issued in payment for the gas and water works as opportunity occurred.

The CHAIRMAN, at the opening of the proceedings on Wednesday, said that the matter of annuities created for payment of the purchase price of the gas and water works raised an important question of principle in regard to the proposals in the Bill for dealing with them. He had been discussing the matter with his brother Chairman sitting in Section B of the Police and Sanitary Committee as to how the question should be dealt with, as it involved a principle which might be raised in the other section; and it was most desirable that their decisions should not differ. He therefore proposed to postpone his final decision until after the discussion, which it was decided should take place the following day.

Clause 90, relating to the application of money borrowed, which was in the common form, was passed; and clause 91, regarding the disposal of the proceeds of the sale of surplus lands, was struck out.

Clause 94 provided that where the reserve fund was insufficient to meet any deficiency in the revenues from gas, such deficiency should be made good out of the district fund—the next general district rate to be made by the Council to be increased so far as might be necessary to recoup to the district fund the amount so made good out of the fund. The clause was accepted, as was the following clause, which related to the application of surplus income from the gas undertaking.

After dealing with the subsequent clauses, the Committee went back to an early clause which authorized the charge of an extra rate for Sabden.

Mr. *Waddington* explained that although Sabden was brought into the gas area, it did not contribute anything to the capital outlay.

Mr. *Whitehead*, in reply to the CHAIRMAN, said that the position had been fully explained to the Parish Council of Sabden. It was put definitely to them that they would have to pay a higher price for their gas than Padiham. The Chairman of the Council agreed that it was only reasonable, under the circumstances, that they should do so.

The clause was ordered to stand part of the Bill.

Sub-section 3 of clause 10, which relates to the charges for gas supplied by prepayment meters, provides that where any consumer taking gas through a prepayment meter shall not in any quarter of the year consume at least 3000 feet, the Council may, in addition to the charge of 1s. per 1000 cubic feet where fittings and a cooking-stove are included, charge, in respect of such quarter, an additional 2s. for the hire of the meter and fittings.

The CHAIRMAN said that to this both the Committee and the Local Government Board objected, even though a new sub-clause to a similar effect was substituted in its place.

Mr. BOYCE said that they could not fairly get any extra charge in the case of a slot-meter, as they could not say by whom the supply was taken. Anyone might put his penny in the slot and use the gas.

Mr. *Waddington* said the house would be let to one person; and he would be responsible for the gas.

The CHAIRMAN said that the man recognized as the consumer might use no gas, and so receive no benefit; while a person lodging upstairs could put his penny in, burn the gas, and incur no liability for the meter.

Witness said that in Padiham the houses to be supplied with slot-meters were cottages; and the father or mother would be the head of the house.

The CHAIRMAN: You are drafting a new clause; and we have to consider not only the present, but the future also. Supposing the house was divided into two floors. The tenant on the ground floor might be registered as the consumer; while the tenant on the first floor was the person who used the gas. It would be doing that person a gross injustice to make him pay the extra charge. As soon as it is found in Padiham that it is better for a man to take half a house instead of a whole one, you would be faced with this difficulty.

In reply to Mr. KEEN, witness said that where gas was supplied separately, separate meters were put in. The point he desired to make was that such a thing did not occur in Padiham.

The CHAIRMAN: You say it does not occur; but you cannot say it could not occur.

Witness: If a man asks us to put a meter in on certain conditions he makes a bargain, and ought to be bound by it.

The CHAIRMAN said he thought it a hard thing for the consumer that the Council should have power to charge him a higher price as proposed. He doubted whether they ought to have the clause at all. Their price for gas was now 3s. 4d.; and they were putting upon the poor people an extra charge to cover any loss which they might incur from the use of prepayment meters. If one person did not consume 3000 cubic feet, another might take 15,000 feet by an ordinary meter. Surely they could rearrange their charges so as to meet the difficulty. They could make a trustworthy estimate of what was likely to be the result.

Witness said that the man who had the meter, if he would not use it, ought to make some return for the outlay.

The CHAIRMAN: But you have the power to remove the meter if you find it is not being used.

Witness pointed out that the Council supplied fittings and cookers free of charge.

The CHAIRMAN: What you are asking is that we should put upon a number of poor people an injustice in order to save the Corporation trouble. You can vary your charge. One penny per 1000 feet addition would cover all the cost and leave a margin. The Committee refuse the whole clause.

The clause was accordingly struck out.

Clause 89, giving powers for the redemption of the gas and water annuities after 30 years, was ordered to stand part of the Bill.

The CHAIRMAN observed that the present holders had had ample notice of the proposal, and had not entered any opposition. Although it was creating a precedent, the Committee would agree to it.

The Committee then went through the schedules and passed the preamble of the Bill.

LEGAL INTELLIGENCE.

EMBEZZLEMENT BY A GAS COMPANY DIRECTOR.

Sentence of Penal Servitude.

Robert M'Vicar, draper, of Ayr, Chairman of Directors of the Ayr and Newton Gas Consumers' Company, who was recently arrested on a charge of having embezzled large sums of money belonging to the Company—stated in the complaint to amount to £10,650—pleaded guilty before the Sheriff at Ayr, about ten days ago, to having misappropriated £9000, and was remitted to the High Court of Justiciary for sentence. He was brought before Lord Ardwall at a sitting of the High Court in Glasgow last Thursday.

It was stated by Counsel for the prisoner that his client first became connected with the Company about twenty years ago, when he was appointed a Director. After having been a member of the Board for a year or two, he was unanimously elected Chairman. He at once set about reorganizing the affairs of the Company, with the result that in a short time he was successful in raising money sufficient to practically reconstruct the entire works. About 20 miles of piping also were laid. When he became Chairman, the Company were only paying a dividend of 4 per cent. upon a capital of £16,000. In connection with the installation of the new plant and the laying of the pipes, there was considerable expenditure; and the accused and the other Directors came under personal liability for it, by bills and otherwise. The improvements were successfully carried through, and the capital of the Company was increased—first to £17,000 and afterwards to £20,000. Counsel did not wish to minimize the loss sustained by the shareholders on account of the accused's embezzlement; but he desired to point out that during the time the concern was managed by him the dividend steadily increased, and 8 per cent. was paid in the past two years. Within the last year or two the works had been again almost entirely reconstructed, and the capital increased from £20,000 to £40,000; and there was, in addition, £15,000 of 4 per cent. preference stock. The real cause of the disaster in which the accused found himself involved was that he devoted far too much of his

time and energy to the Company, and neglected his own affairs. He had been connected with a general drapery business in Ayr all his life, and he took it over himself in 1897. From the outset it had not been successful; and the sum of £9000 was entirely accounted for by losses in connection with it. This was a case in which there was no speculation on the Stock Exchange nor extravagant living; the household expenditure of the accused having never exceeded £300 per annum.

Mr. W. THOMSON, advocate-depute, who prosecuted, admitted that the accused had rendered considerable assistance to the Company, and that the financial work was almost entirely in his hands, but he could not say that the whole prosperity of the Company was due to him.

Lord ARDWALL, who presided, said the accused had pleaded guilty to a very serious charge. He (his Lordship) had paid attention to what had been said by Counsel; but he would observe that it would be a very strange thing indeed if the fact that a person had contributed to the success of an undertaking entitled him to rob it or the shareholders by way of a set-off. He did not suppose this was suggested. Unlimited trust had been reposed in the accused by the shareholders; and he had abused that trust by embezzling. He could not regard this as other than a most serious offence. When he first read the case, he thought that a more severe sentence than he was going to pronounce would have been justified. He might observe that these sentences were really intended, not to reform the criminal, but to deter others from committing crime. The day was past when these crimes could be visited with light sentences; and the very lightest he could impose was penal servitude for seven years.

Daring Theft of Gas-Fittings.

At the Old Street Police Court last Friday, before Mr. Cluer, Benjamin Snelling, described as a labourer, residing at 46, Selby Street, Bethnal Green, was charged with being concerned with two other men still at large in breaking and entering 4, Pritchard's Road, Bethnal Green, and stealing gas-fittings belonging to the Gaslight and Coke Company. A solicitor representing the Company explained that on the preceding afternoon the three men were overheard by a general dealer living at 2, Pritchard's Road, to refer in a suspicious manner to "No. 4." The dealer, rightly concluding them to be gas-fitting thieves, kept them under observation, and saw them break into No. 4, which was unoccupied. From his place of concealment he ran to the door and held it, so that when the prisoners returned to get out they could not do so, and had to climb a wall at the rear. He had heard them wrench down the gas-fittings mentioned in the charge, and chased them when they ran away. By his information, the prisoner was traced to St. Paul's School by a constable, to whom he denied any intention of hiding. All the fittings were found in a heap in the house, ready for removal. The accused was remanded until to-morrow.

The Charge against Kent County Gas Company Promoters.

At the Mansion House last Wednesday, Henry Warwick Gyde (otherwise Peter Henry Bernard) and Maurice Edward Septimus Bernard (otherwise Septimus Marcus), brothers, both on bail, were charged on remand (see *ante*, p. 301) before Alderman Sir James Ritchie with having conspired together and with Walter Darby (not in custody) to obtain by false pretences moneys and securities from such persons as should be induced to become debenture-holders in the North Wales Slate Quarries, Limited, and the Welsh Slate Quarries, Limited. Gyde and Darby, it will be remembered, were concerned in the promotion of the Kent County Gas Company. The defendant Marcus was Secretary of the two Slate Companies, and wrote letters to people, asking them to buy debentures, in which representations were made which were said to be false. The Companies were compulsorily wound up in February, 1906. Only £23 worth of slate appeared to have been sold. Mr. E. V. Fox, Examiner in the Companies Winding-Up Department of the Board of Trade, who had investigated the affairs of the two Companies, gave detailed evidence as to their formation and career; and the further hearing of the case was adjourned—the defendants being admitted to the same bail as before.

Compensation for Injuries through an Explosion.

At the Liverpool County Court last Thursday, before his Honour Judge Shand and a Jury, a gas worker named Neill Kerr, of Bootle, sued the Liverpool United Gas Company for compensation, under the Employers' Liability Act, for injuries sustained through an explosion in their works at Linacre, on the 24th of November last. The plaintiff's case was that while on duty in the retort-house with a gang of men clearing an obstruction of pitch from the hydraulic main, an explosion occurred, which hurled him across the place against another main. Four or five other men were injured at the same time, and all were taken to the Bootle Hospital. Plaintiff was there for a month, and was still under medical care, suffering from nervous shock, and with his left side defective in sensibility and power. He was unable to do any work heavier than, as Dr. Glynn, one of his witnesses, suggested, sitting on a wall watching sheep. It was alleged that the explosion was due to the negligence of the foreman in opening the lid of the retort before sufficient time had elapsed to allow the gas to get away. For the defence, evidence was called to show that the explosion was unaccountable. In the result, the Jury found for the plaintiff, awarding him £100 damages; and judgment was given accordingly.

Compensation for "Heat Stroke."

At the Leeds County Court last Wednesday, before his Honour Judge Greenhow, the adjourned hearing took place of a case in which Fred Jennings, aged 38 years, in the employ of Messrs. Clayton, Son, and Co., Limited, of Leeds, made a claim under the Workmen's Compensation Act. It was a case which raised for the first time the issue as to whether a workman suffering from "heat stroke" is entitled to compensation if incapacitated from its effects. The applicant was represented by Mr. R. A. Shepherd, and the firm by Mr. J. O. Andrews. At a previous hearing, it was stated that Jennings was one of a number of men who from time to time went about altering and repairing boilers and gas-retorts for their employers. Last summer, the plaintiff and others visited London to carry out some repairs to the boilers at the South Metropolitan Gas-Works at Vauxhall. While at work the heat from the other boilers was so great that he had to come out in order to obtain fresh air. He was affected by dizziness, headache, and sickness, and was finally compelled to return to Leeds. He was incapacitated from work. Mr. Andrews called evidence to the effect that the plaintiff was suffering from a kind of paralysis, and that it was not the result of "heat stroke" produced by working in the boiler. His Honour, after hearing the arguments, decided that the plaintiff was suffering from the effects of "heat stroke," and that this was an accident within the meaning of the Act. He awarded the plaintiff the arrears of compensation (£40), £1 a week during his future incapacity, and costs.

Dispute between Lincolnshire Water Companies.

In the Chancery Division of the High Court of Justice last Tuesday, Mr. Justice Neville had before him an action brought by the Bourne Water-Works Company against the South Lincolnshire Water Company for specific performance of an agreement dated Jan. 19, 1906, for the purchase by the defendants of the plaintiffs' undertaking. Mr. E. Brodie Cooper, who appeared for the plaintiffs, said he had communicated with Mr. Cann, who had signed the defendants' pleadings, but had been informed that he was not briefed to appear. A defence had been put in alleging misrepresentation, and the defendants counter-claimed for rescission. They had, however, failed to give particulars of the alleged misrepresentation; and substantially the whole of the defence had been struck out. The plaintiff Company was formed some 52 years ago to supply the town of Bourne, in Lincolnshire, with water, and had supplied it ever since. The defendant Company was incorporated by Act of Parliament in 1906. The plaintiffs opposed the Bill, but withdrew their opposition on a conditional agreement being entered into with the promoters. This agreement, which was scheduled to the Act, provided for the sale of the Bourne Company's undertaking to the Lincolnshire Company for £5000. The purchase was to be completed by Sept. 29, 1906; but nothing had been done except that the defendant Company had paid the plaintiffs £500 by way of deposit. The latter did not ask for an injunction; but they claimed a declaration that the deposit of £500 was forfeited to them, and that the defendants should pay to them a sum of £52 10s., which it was agreed should be paid for costs in the event of the purchase not being carried through, and the costs of the action. His Lordship, having read the defence, said the plaintiffs appeared to be entitled to the order they asked for; and he gave judgment accordingly.

Pollution of Water by Sewage at Malvern.

In the "JOURNAL" for the 4th of February (p. 303), we reported a case, which had occupied Mr. Justice Lawrance and a Special Jury for eleven days, in which Dr. Fergusson, the proprietor of a hydropathic establishment at Malvern, sued the Urban District Council for damages for alleged negligence in allowing his drinking water to be polluted with sewage, which had, it was said, escaped from the sewers under the defendants' control. Plaintiff alleged that in consequence of the defendants' negligence there was an outbreak of typhoid fever at the hydro in May, 1905, and two of the visitors and two servants died. Actions against the plaintiff were brought by the people attacked, in order to recover damages, on the ground that the epidemic was caused by his negligence. Plaintiff paid these damages and costs, which amounted in round figures to about £6500. He claimed this amount from the defendants, and also damages for the loss of reputation which the hydro had suffered by reason of what had taken place at the trial; and he was successful. The defendants now appealed, mainly on the grounds that, upon the findings of the Jury, judgment should have been entered for them, and that the verdict was against the weight of evidence. They further said that Mr. Justice Lawrance had misdirected the Jury. The appeal was heard by Sir Gorell Barnes and Lords Justices Fletcher Moulton and Farwell. Sir Gorell Barnes, in giving judgment, said it was clear from the evidence and the admitted facts of the case that it was the defendants' water which flowed down to the plaintiff, and which should not, in the ordinary course, have percolated into his pipes; but there was nothing to show that the Council altered the course of the pipes. In the circumstances, he could not see any breach of duty by the Council towards the plaintiff; and he thought that, upon the findings of the Jury, judgment should be entered for the Council, with costs. Lords Justices Fletcher Moulton and Farwell concurred.

Theft of Gas.—The Smethwick Magistrates had before them on Monday last week a charge of stealing gas, the property of the Corporation, brought against George Eden, a baker of West Smethwick. According to the evidence, Mr. B. Skidmore, the chief collector, visited the defendant's house on the 25th ult., and going in the cellar discovered that a pipe had been connected with the gas-main and attached to a small gas-boiler. The meter had been disconnected on the 6th of March, and taken away; the service-pipe being properly capped. This had been removed and another cap and pipe connected. For some six or seven months prior to the removal of the meter no gas had been registered by it. Mr. Skidmore said it was a most risky and dangerous thing to remove the cap from the service-pipe without the gas being shut off. Defendant, who did not appear, was fined 40s. and costs—£2 9s. 10d. in all.

The Pontefract Corporation have placed with Messrs. F. C. Sugden and Co., of Leeds, an order for a new retort-bench, complete with all ironwork. The settings are of the deep Klönne regenerative type, with the Hudson patent producer. The work is to be carried out under the supervision of Mr. L. V. Whitaker, the Corporation Gas Engineer.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Meeting of the Association was held last Tuesday, at the City Terminus Hotel, Cannon Street, E.C.—Mr. J. HORSLEY PALMER in the chair.

The SECRETARY (Mr. R. W. Wilson) read the notice convening the meeting, and then the following report of the Directors:—

The Directors have the pleasure to report that the results of the Association's operations for the second half year 1907 have been satisfactory.

The profit of the half year, added to the sum of £25,835 brought forward from the preceding half year, amounted to £263,410, as compared with £238,640 for the corresponding period of 1906.

In view of the circumstance that the Association's gas-works in France were last year converted into a separate French Company, no useful purpose would be served by giving, on the present occasion, the comparative figures of the total working results obtained in the second half years of 1906 and 1907. It should, therefore, be understood that any figures given in this report with regard to the results of the past half year refer to the workings of the Imperial Continental Gas Association alone.

The coal carbonized during the half year amounted to 512,767 tons, at an average gross cost of 19s. 3d. per ton—the highest average price since 1901, when the gross cost of coal was 20s. 11d. per ton. Some compensation was, however, obtained from favourable contracts concluded for the sale of coke.

The number of consumers at the Association's stations at the end of the half year shows an increase of rather over 11 per cent. per annum—a rate of increase which has been steadily maintained for the past five years.

The plant and mains at all the stations were maintained in their usual efficient condition.

Seventy-six miles of new mains were laid in the half year under review.

Progress was made at Antwerp with the construction of the new works at Hoboken. The tank for gasholder No. 1 was finished, and that for gasholder No. 2 was considerably advanced towards completion. The erection of the first gasholder was also commenced, and further work was done to the pier and jetties. Contracts were let for the construction of the first retort-house, for the retort-benches, and coal-store, and for two electrically-driven coaling cranes, together with the necessary conveying plant.

A contract was concluded with the Commune of Contich (a suburb situated to the south of Antwerp) for the exclusive supply of gas there for 28 years—*i.e.*, until Dec. 31, 1935.

At Berlin, the eight furnaces of vertical retorts and the third section of water-gas plant referred to in the last report as being in course of erection at Mariendorf were completed. Preparations were made for the erection of thirteen additional furnaces on this system. Extensions of the high-pressure plant and of the coke-handling machinery were also proceeded with.

A further plot of land adjoining the Weissensee works was bought at a reasonable price.

At the Forest works at Brussels, the second bench of inclined retorts, with coal and coke handling machinery, was completed, as were also the new carburetted water-gas plant and the new sulphate works at Koekelberg.

The Woluwe electricity station, which was destroyed by fire on Feb. 13, 1907, as stated in the report for the preceding half year, was rebuilt, and was put in action on Oct. 4 last.

A contract was concluded with the commune of Tervueren—a suburb situated to the south-east of Brussels—for the exclusive supply of gas and electricity for a term of 53 years, until 1960.

The contract for the exclusive supply of gas to the town of Cernay, in Alsace, was prolonged for a period of 20 years—*i.e.*, until 1936.

At Hanover, the additional coal and coke handling plant and the new cyanogen washer, referred to in the last report, were completed.

A contract was concluded with the suburban commune of Seelze, securing to the Association the monopoly of the supply of gas for 43 years, until 1950.

At Vienna, a plot of land, for which the Association had no further use, was disposed of at a satisfactory price.

At Armentières—one of the towns supplied by the Compagnie Continentale du Gaz—an extension of the concession for the exclusive supply of gas was obtained for 33 years; and a monopoly for the supply of electricity was secured for 43 years—the two concessions thus terminating on the same date in 1950.

In conclusion, the Directors desire to draw the attention of the proprietors to the Association's accounts for the half year under review and to the balance-sheet, copy of which was appended to the circular calling this meeting.

These accounts have been duly audited, and from them the Directors have, in accordance with the provisions of the Companies' Clauses Consolidation Act, prepared a scheme, showing the profit of the Association for the half year, and the portion thereof applicable to the purposes of dividend, which they recommend now to be declared—viz., a dividend of 4 per cent. for the half year ended Dec. 31 last, payable, free of income-tax, on and after Tuesday, the 12th inst.

The Directors who go out of office by rotation are: Colonel Herman Le Roy-Lewis, D.S.O., Arthur Lucas, Esq., and Leonard Rodwell Wilkinson, Esq. These gentlemen are eligible for re-election, and offer themselves accordingly. The Auditor who goes out of office by rotation is Montagu Somes Pilcher, Esq., who is eligible for re-election, and offers himself accordingly.

Scheme for the Division of the Profits of the Half Year ended Dec. 31, 1907.

Balance brought forward from last half year. .	£25,835	1 10
Profit resulting from the workings at the stations and dividends on investments, less interest on debenture stock, and the charges on account of depreciation and income-tax. .	237,575	13 10
	£263,410	15 8
Dividend at 4 per cent. for the half year . . .	£197,600	0 0
Credit to pension reserve	35,000	0 0
Balance carried forward to next half year . .	30,810	15 8
	£263,410	15 8

COAL CARBONIZED AND THE PRICE.

The CHAIRMAN, in moving the adoption of the report, said that six months ago he spoke to the proprietors at great length about the new departure the Directors had made in starting a French Company to take over the business of the Association in France. He did not intend that day to go into this matter, but he would merely refer to it in passing, because, as the report said, the Directors could not give the proprietors a comparative statement with the correponding half of the previous year, as they had been in the habit of doing, neither was he able to enter into these matters in his speech. But there were several points of interest in the working of the half year at the stations of the Association about which he should like to speak; and the principal one was with respect to the coal supply. They had during 1907 created a record in the carbonizing returns, inasmuch as they had now, for the first time in the history of the Association, passed the amount of 1 million tons of coal used in a year at their different works. Then the second point to which he wished to refer was the exceedingly high price of coal. The gross cost came out at 19s. 3d. per ton; and only twice in the last thirty years had it been higher. In 1900, it was about 21s.; and in 1901, it was 20s. However, it was not always the gross cost of coal which affected the results of a half year. They were fortunately able to make very favourable contracts for coke; and the result had been that the net cost of coal had corresponded very nearly to what it had been during the last five or six years. It worked out to about 7s. 5d. Then again this satisfactory result was not only to be attributed to coke. They had, of course, spent vast sums in machinery of all sorts for improving the carbonization and for handling the coal and coke; and this had undoubtedly contributed very largely indeed to the profits, and also minimized the effect of the higher coal prices. There was one point he desired to emphasize; and it was that the current half year might suffer somewhat severely from the high price of coal. It might seem rather peculiar for the Chairman of a Gas Company speaking to the proprietors in the month of May—a year after the high-priced contracts were made—of continued suffering from the heavy cost of coal. But if the proprietors considered the position of the stations in North Germany, where the waterways were frozen up for many months, and where the inclemency of the weather was such that they could not obtain coal very readily, it would at once be seen by them why the Association had been obliged to ship large quantities of dear coal to be carbonized after Dec. 31 last. Therefore, they would probably feel the effects of the high price more during the present six months, because they were carbonizing dear coal, and at the same time the value of coke had fallen. There was one very good point in the future of coal, that, during the early spring of this year, the Directors managed to make favourable contracts for the coming year; and he had no hesitation in telling the proprietors that they had made contracts at about 2s. per ton less than they paid last year. There was one regrettable feature about Continental coal which he should like to mention, because nearly every engineer in the employ of the Association who had had to use Westphalian and Belgian coal had complained most bitterly of the bad quality delivered to him. The proprietors were perhaps well aware that the Westphalian mines were run by a Syndicate; and no amount of complaint or claim seemed to have the slightest effect upon them. They would not guarantee any particular quality of coal; and one had really now to accept what they chose to send, and also the price they chose to quote. It was very unfortunate; and he thought it was monstrous that gas companies, who dealt so largely with the Syndicate, should be so treated.

RESIDUALS AND INCREASED GAS CONSUMPTION.

With regard to the bye-products, as he had said, coke had realized good prices; but they had received less money from tar and ammonia, especially from tar, because the price of pitch had been so abnormally low. Then with reference to the sales of gas, a pleasant feature of the half year had been that, at none of the stations, either of the Association or of the Compagnie Continentale, had there been a decrease in the sale of gas. The average rate of increase was just under 10 per cent. in both cases.

PROFIT AND CAPITAL EXPENDITURE.

It would naturally be thought that, with large increases in the number of consumers and in the sale of gas, the profits ought to be correspondingly large. He had mentioned this subject on several occasions, and had pointed out over and over again that, notwithstanding the considerably increased outputs the Association enjoyed every year, they had always had to expend more capital to do their business, in order to obtain the same profit as formerly. He entered fully into this matter this time last year.

LABOUR—A THREATENED STRIKE AND FRIENDLY ASSISTANCE.

With regard to labour, he was glad to say they had been free from strikes. They were threatened with one at Hanover of considerable dimensions. There they had erected a large installation of labour-saving apparatus—charging and discharging machines—and they were informed by their Engineer that the men intended to suddenly throw up their work. Within 36 hours of the receipt of this information—thanks to the generous help that was afforded the Association by the makers of the machines, and by the great London Gas Companies—they were able to have ready to march into the works at Hanover a large number of men who were perfectly qualified to work the machines; and when the Association's men learned that the Directors were going to stand firm on this point, they accepted the inevitable, and returned to their work. There had been no difficulty since. Of course, this put the Association to a large expense. But he thought it had a salutary effect on the men at Hanover. The Association were also a little troubled by the great dock strike at Antwerp; but, by changing the methods of getting coal there, and having it by rail from Belgium and Germany, they got over the difficulty without any cause of anxiety.

INCREASE IN PREPAYMENT METERS—MONEY-BOX ROBBERIES.

He should like to say a few words on the question of prepayment meters. This was rather an interesting question for the Association, seeing that the use of such meters was growing enormously on the Continent. They had at the present time the large proportion of 27 per cent. of the total number of their consumers on the prepayment system. An interesting point about prepayment meters was that, while in England they were continually hearing of the money-boxes being broken open, and of thefts of the money, they had, at the Association's stations, an exactly opposite experience. When he told the

proprietors that in Berlin, they had 31,000 prepayment meters, that the total number of thefts there during 1907 was only 367, and that the net amount lost only amounted to 75s., it would be seen that these robberies were not a very great burden on the Association.

NEW CONTRACTS FOR GAS SUPPLY.

A few words had been put into the report with regard to the new contracts made during the past six months. Of course, one of the greatest anxieties the Directors had to go through was the renewal of, and the making of new, contracts. Most of the stations were, as the proprietors were aware, practically leasehold; Berlin being the exception. The Directors had been fairly successful in regard to their duty in this respect, as was shown by the fact that in 1897 the total number of contracts was 144, with an average length of 28 years; while on Dec. 31, 1907, they had 275 contracts with the same average duration of 28 years—that was to say, although ten years had elapsed, their position was now just the same, in fact better.

RETIREMENT OF HERR LEONARD KÖRTING.—THE NEW ENGINEER AT HANOVER.

He now wished to refer to a matter which he might describe as of domestic interest. The proprietors were aware that they had on the Continent and in London a large staff of very able and devoted servants—men who spent not only their talents and their energies but their whole lives in the service of the Association, who were always ready to meet any emergency that might arise, and to tackle the most difficult engineering problems, as well as the most difficult municipalities. But there came a time in the life of every man—no matter how good he might be—when he had to lay down his tools, or had to take his hand off the plough which had ploughed a long furrow of good, honest work for many years. That time had come to their old friend Herr Leonard Körting, of Hanover. He had been in the service of the Association for 53 years; and he felt that the time had come when he should send in his resignation, which was accepted by the Board with great regret. Still he thought Herr Körting was right, because he had reached a time of life when—he (the Chairman) did not say he was past his work, but still he had sufficient vigour left to enjoy life and the art [painting] that he loved so much, as well as the pension the Directors had awarded him. He was exceedingly glad to see their old friend at the meeting, looking so well and hearty. [There were loud cheers from the proprietors, which Herr Körting acknowledged by rising.] He (the Chairman) would not say that this was the last time that they would see him at their meetings; for he certainly hoped that Herr Körting would live many years to enjoy his pension, and that he would be able to give them, on many occasions, of his ripe experience and sound advice with regard to their affairs at Hanover. He might say that Mr. William Anderson, who had been the Chief Assistant Engineer at Hanover for many years, and who had been in the service of the Association since 1878, had been appointed to fill Herr Körting's place.

POINTS FROM THE BALANCE-SHEET.

There were a few figures in the balance-sheet to which he desired to refer. The only noticeable item on the debtor side was sundry creditors in London, which was £30,000 more than six months ago. This was practically all due to contracts made for the completion of the Hoboken works. The profit for the half year was £3400 over the figure for the corresponding half of 1906. The creditor side of the balance-sheet showed material alteration. The amount for which the French stations were entered in previous balance-sheets, under works, mains, and land—now that these stations had been formed into a separate French Company, with shares all belonging to the Association—had been transferred to "Investments and loans abroad;" thus diminishing the figure of the former item, and increasing the amount of the latter.

PROSPECTIVE FRESH CAPITAL ISSUE.

But the most important matter about which he wished to speak related to the future and to the capital expenditure. He would quote a few words from the speech he made in May, 1903:

> It must be within the knowledge of the proprietors that, with an expanding business like ours is in some of the great capitals of Europe, it is impossible to avoid making a large capital expenditure. During the past five years, we have spent a very considerable amount; and I foresee, as the business continues to expand, that we shall have to spend in the future very large additional sums on capital account. That is merely foreshadowing what I believe will take place.

Since he made these remarks, the Association had expended more than a million sterling up to December last; and the extensions required by the business was an average of about £250,000 annually. This expenditure would go on. They were, as he told them, building immense works for the City of Antwerp, where their business was increasing by enormous strides. He foresaw that the same sort of thing would have to be done at Frankfurt; and he also saw they would have to put their hands in their pockets for a large amount at Berlin, therefore, it was absolutely necessary they should be in a position to have more capital. There were practically only two methods of raising additional funds—viz., by the creation of new capital stock, or by the issue of debentures or debenture stock. Regarding capital stock, by the Acts of 1870 and 1878, the Association were authorized to issue a further £700,000. Of this they had issued £300,000; and there was a balance of £400,000 unissued. Respecting the loan capital, the Association's Act of 1893 declared that the total amount of the debt outstanding should not at any time exceed one-fourth part of the issued capital, fully paid-up. They had at present £4,940,000 of capital, and total borrowing powers amounting to £1,235,000; and they had an existing debenture stock of £473,550, which left them a balance of £761,450, which they had power to issue. He thought it right to tell the proprietors that the Board intended, at the meeting next November, to ask them for authority to issue, as and when required, the balance of the loan capital authorized.

Mr. ARTHUR LUCAS seconded the motion.

Mr. HERBERT CROFT said with regard to the "Investments in English and Indian Securities, £269,677," did this represent the price at which they were bought? He asked this because the next item "Investments and Loans Abroad (£1,823,987)," was followed by "less depreciation £306,501." It was an exceedingly wise policy to write down the investments to the market price of the day; and, the Association being conducted in the most prudent way, he imagined the Directors adopted this policy in connection with the investments.

The CHAIRMAN replied that the Directors had written down the securities—in fact, he believed if they sold them at the present time, they would make a substantial profit on them. They were written down quite sufficiently to be on the safe side. The depreciation on investments and loans abroad was really a sinking fund on the businesses in the French Company. They had to depreciate their stations in the French Company just as much as they depreciated the leasehold stations of the Association.

The motion was unanimously carried.

Proposed by the CHAIRMAN, and seconded by Mr. J. HENRY BIRCHENOUGH, C.M.G., a dividend was declared of 4 per cent., free of income-tax, for the half year ended Dec. 31 last on the £4,900,000 of stock.

On the motion of the CHAIRMAN, seconded by Mr. CORBET WOODALL, Colonel Le Roy-Lewis, D.S.O., was re-elected to his seat at the Board; as was also the Deputy-Chairman (Mr. Arthur Lucas) on the motion of the CHAIRMAN, seconded by Sir CHANDOS LEIGH, K.C.B., K.C., and Mr. Leonard R. Wilkinson, on the motion of the CHAIRMAN, seconded by Mr. ROBERT TINDALL.

The retiring Auditor (Mr. Montagu S. Pilcher) was reappointed on the proposition of Mr. BERNARD F. HARRIS seconded by Admiral CHURCHILL.

INCREASE IN THE DIRECTORS' REMUNERATION.

Sir JOHN RUNTZ, pursuant to notice, moved—"That in consideration of the increase in the Company's operations in recent years, and the consequent additional responsibility and labour thrown upon the Board of Directors, resolved that the Directors' remuneration be, and is hereby, increased from £5000 to £6000 per annum as from Jan. 1 last." In the course of his remarks, Sir John said he had been much struck with the amount of work the Directors had to do to maintain the Association in the enjoyment of its great prosperity; and he thought the amount of remuneration, compared with that paid to the Boards of some of the chief banks, was very small indeed. He therefore ventured to think the proprietors would adopt the resolution he submitted to them. It was thirty-two years since any increase was made in the Directors' fees. In 1876, there was an increase from £3000 to £5000; and there the amount had stood. Much had occurred during the period that had elapsed. In 1876, the capital was £2,800,000, in 56,000 shares of £50 each, with £43 15s. paid—the actual capital being £2,450,000. The dividend then amounted to £294,000. Thirty years ago, they had fifteen stations; now the number was fourteen. The Directors, however, had control now of seven subsidiary companies with 31 stations; making 45 establishments in all. This alone showed how greatly the labour and responsibilities of the Board had increased. Since 1876, three distributions to the proprietors had been made by the Directors of capital out of undivided profits. This was done in 1881, in 1883, and as recently as 1906. In 1881, from undivided profits the £6 5s. liability on the £50 shares was paid; in 1883, 25 per cent. was given to the proprietors; and in 1906, 30 per cent. The total amount subscribed and paid up by the proprietors in cash was only £1,500,000; and the difference between this sum and the figure at which the capital now stood was chiefly made up by capital given to the proprietors out of undivided profits. The evidence all showed that they had the right men in the right place, conducting this huge undertaking. The profits too had followed a progressive course. The Association's investments and liquid assets ten years ago stood at £1,115,000; while to-day they were £2,367,000, or an increase of nearly £800,000. These figures spoke for themselves, and justified the resolution he had proposed. They must all admit that the Directors had done good service, and that these services deserved to be recognized in a substantial manner. Sir John also referred to the visits of the Directors to the stations, and to the continued good duration of the life of the Association's contracts.

Mr. GURNEY FOX seconded the motion, and supplemented the remarks of the proposer of the resolution. Among his observations, he said the proprietors were much indebted to the Directors for having brought the Association to its present state. He did not believe there was a finer property in existence; and he thought the future of the Association would be as good as the past—and better.

The resolution was passed by a unanimous vote.

The CHAIRMAN, acknowledging it on behalf of himself and colleagues, referred to the charming way in which the resolution had been put to the meeting, and to the cordial approval of the proprietors. He did not hesitate to say that the position of a Director of the Association was a very arduous and difficult one, and still more so was the chairmanship. The Directors had a great many anxieties and difficulties on the Continent, and a great many journeys to undertake; and he did believe they thoroughly deserved the vote. What had been said, and what had been done, he took as a great compliment to the Board.

On the motion of the CHAIRMAN, a hearty vote of thanks was passed to the Engineers and staffs on the Continent and to the Secretary and staff in London.

This concluded the somewhat protracted proceedings.

Cheap Gas and Smoke Abatement in Sheffield.—In an article entitled "Sunny Sheffield" which appeared in the "Manchester Guardian" last Tuesday, an account was given of the crusade against the smoke nuisance, and its effects were shown in some figures of the hours of sunshine last year in Sheffield as compared with Manchester—1428 in the former, and 894 in the latter city. Sheffield's advantage is attributed to the instruction given by the inspectors in the methods of avoiding smoke; but our Manchester contemporary, referring to the matter, asks if there are no other factors. For instance, it is pointed out that "gas is only 1s. 4d. per 1000 cubic feet in Sheffield, with a reduction on quantity;" and it is asked: "Is there, as one would expect, a greater use, in consequence, of domestic gas heating and cooking than in towns like Manchester, where gas is from 2s. to 3s. per 1000?"

BUENOS AYRES (NEW) GAS COMPANY.

Good Development—Municipality and the Three Gas Companies.

The Annual Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, No. 1, East India Avenue, E.C.—Mr. J. C. IM THURN in the chair.

The SECRETARY (Mr. J. M. Macmorran) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

The CHAIRMAN, in moving their adoption, said he regretted to say that Mr. Heseltine, by reason of feeble health and advancing years, had found it necessary to resign the post of Chairman at the annual meetings; but he (the Chairman) was glad to be able to report that he still retained his seat on the Board, and gave his colleagues the benefit of his long experience. Regarding the report and balance-sheet for 1907, he thought he might say the shareholders would find them satisfactory. It would be seen that the amount to the credit of the revenue account was £85,733. This was made up of £60,689 profit for the year and £25,044 brought forward from 1906. This profit showed a slight decrease on that of 1906; but this was due, in great measure, to the high cost of coal and freights—these having cost 2s. 4½d. per ton more than in the previous year. Moreover, they had spent out of revenue £10,806 more than in 1906; part of this sum being for the complete renewal of three benches of inclined retorts. For the present year the prospects were more favourable as the price of coal had declined somewhat, and freights had dropped considerably. The Directors had appropriated the £85,733 thus—To the 4 per cent. debenture stock, £10,000; to interim dividend, £18,000; to final charge in respect of the issuing of debenture stock, £2112; to interest on new capital to June 30, 1907, £1348; and it was now proposed to pay a final dividend of 8s. per share, which (with the interim dividend) made 7 per cent. per annum, free of income-tax, £28,000—leaving, to be carried forward, £26,273. The Directors had not considered it necessary to place any further amount to renewal and contingency fund, as the sums already provided were amply sufficient for the moment. Out of the year's revenue, £30,562 had been expended on the upkeep of the works, mains, &c., all of which were in a high state of efficiency. An increase was shown in the sales of gas of 7·85 per cent. over 1906; and this, on top of an increase in 1906 of 9·45 per cent. over 1905, was very satisfactory. The Company supplied the light to 7683 public lamps during the year; being an increase of 258 over 1906. The number of gas-stoves in use at Dec. 31 last was 5077; being an increase of 696 over the preceding year. Turning to the balance-sheet, it would be seen that the expenditure on capital account was £13,425. The final quota of the discount and expense incurred in the issue of the debenture stock had now been paid off; and this item (amounting to £2112 per annum) would therefore not recur. The investments consisted principally of £150,000 in the shares of the South Barracas Gas Company, representing the total issued capital of that Company, and £5000 in the "A" shares of the Bahia Blanca Gas Company, together with 12,500 "B" shares of £1 each in the concern. In this connection, the Directors had to report that the Construction Syndicate was taken over by the Bahia Blanca Gas Company last July, as would have been noted from the prospectuses then sent to the shareholders. The Directors were happy to say that, from the latest advices received, the business of the Company was progressing rapidly, and promised to become a flourishing concern ere long. With respect to the South Barracas Gas Company, the dividend paid was 4½ per cent. as against 5 per cent. in 1906. This reduction was mainly due to the fact that a large amount of expended capital was not yet bringing in its full share of profit; but, in addition to this, there was another factor, which was that building operations were greatly retarded through the absence of good water in the district—residents having at present to rely entirely on wells. As already reported, the Company had obtained a very favourable concession for the supply of water in the district; and (since the last report) all the plans had been prepared, and the land purchased for the necessary pumping stations. The time therefore had now arrived when a Construction Syndicate or Company should be formed to carry out the works. This the Board were about to take in hand at an early date; and the Directors would see that, as far as possible, the shareholders were given the opportunity of subscribing for the shares when the issue was made. The Board had every reason to believe that the shares would be found not only a sound and paying investment, but that so soon as a really efficient water supply was obtainable, a large increase in the erection of buildings would take place, and, as a consequence, an increased demand for gas. On the whole, therefore, he thought the Directors had been able to give a good account of their stewardship in 1907; and they saw no reason why the business should not do just as well or better in 1908. In this connection, there was one matter they had to bring before the shareholders. The municipal authorities, actuated, and rightly actuated, by the desire to do their best for the Municipality, succeeded last year in arranging a scheme with the German Electric Light Company in Argentina, by which the maximum selling price was fixed, and the whole of their property was to revert to the Municipality at the end of fifty years. They then turned their attention to the three Gas Companies, with a view to induce them to fall in with a similar arrangement. But the basis was so low that the Board at once saw it was practically impossible to accept their proposal, as the maximum selling figure would not have allowed the Company to pay their debenture interest, far less any dividend on the share capital. Negotiations went on for some months; but towards the end of the year, the extreme element of the Municipal Council (just before that body retired, as was customary) succeeded in passing an "ordenanza" or decree, fixing the selling price on a lower sliding-scale, with a precarious concession for only ten years. This, of course, the Companies were unable to accept, nor did one of the other Gas Companies; but the remaining Company deemed it better at the time to come to an *ad referendum* agreement with the Municipality, although it contained many undesirable features. The shareholders would understand that the Board found the position a very difficult one, and they and the one other Company referred to came to the joint conclusion that the only course was to instruct their lawyer to appeal to the Courts against this ordenanza, which meantime had been prorogued to April 1 last. The Directors then had the Company's General Manager (Mr. Obarrio) over, as also did the other Company, and jointly they drew up an *ad referendum* agreement to be presented to the Municipality; the basis being somewhat similar to that of the Municipality with the German Electric Light Company. Mr. Obarrio had been with the Company the whole of his business life—that was, over thirty years. He had a thorough knowledge of all matters connected with the progress of the gas industry in the River Plate during that time; and his assistance here at the last juncture was most useful. Meanwhile the Company which had made the *ad referendum* agreement with the Municipality, finding it impracticable, had cabled out to Buenos Ayres that they were unable to carry it through. They then joined with the other two Companies in the joint draft agreement already referred to; and this had been sent out to Buenos Ayres. The Directors hoped and thought the Municipality would accept their suggestions, which were very favourable to them, and at the same time equitable to the Companies. The opinion of the Board was strengthened by a cable received on April 13 from their Manager, as follows: "Municipal scheme very well received. Municipal Intendente has asked Municipal Council to suspend ordenanza in order to treat with the three Companies." The Directors also received on Saturday, May 2, another cablegram as follows: "Ordenanza has been postponed until July 1 by Council in order to treat with the three Companies." The shareholders would, of course, be advised when any arrangement was concluded, and be called together to receive full explanations of its bearings on the business. It would not, the Directors trusted, have the effect of reducing dividends; and it would put the Company on a stable basis for fifty years, at the end of which period the capital would have been completely amortized, and the reserves preserved intact.

Mr. ROSS PINSENT seconded the motion.

Mr. BENNETT asked, supposing the Municipality went contrary to what the Companies proposed, whether it would be very expensive for the Board to defend the action in Buenos Ayres.

The CHAIRMAN replied that it was difficult to say what the expense would be, if it came to defending a suit. But whatever it was, it would be borne jointly by the three Companies, because they were proceeding together; and it was thought that would be much better in the interests of the Company.

The motion was unanimously carried.

Proposed by the CHAIRMAN, and seconded by Mr. ROBERT NESHAM, a dividend was declared at the rate of 7 per cent. per annum, free of income-tax, 3 per cent. of which has already been distributed.

The retiring Directors (Mr. J. C. im Thurn and Mr. Nesham) and the Auditors (Messrs. Turquand, Youngs, and Co.) were re-elected.

Mr. PINSENT said the shareholders had heard from the Chairman the sort of year the Company had experienced. It had been a year of prosperity; and it had been a year of arduous and anxious work in many ways. It would be readily understood that, if the year had been an anxious one for the Board, their Local Committee and the staff in Buenos Ayres and the staff in London had also found it perhaps even a more anxious one. For it had to be borne in mind that, when a difference of opinion arose between two governing bodies, upon those through whom the communications passed fell the brunt. There had been a considerable difference between the Municipality and the Board as to what rate should be charged for gas; and the brunt of this had fallen on Mr. Obarrio and the Local Committee. He thought that his colleagues would agree with him (Mr. Pinsent) that the admirable way in which they had supported the Board during this period of anxious negotiation was a matter of which they could not say too much in praise. The Board at this end had the responsibility of deciding what steps should be taken; but they could only form their conclusions from those at the other end. It was for these reasons that he asked the shareholders to agree with him in passing a vote of thanks to the Local Committee and the staffs in Buenos Ayres and London. Last year, they had the pleasure of welcoming among them Mr. Gibson; this year they had the pleasure of welcoming another member of the Local Committee (Mr. Woolmer). With regard to Mr. Gibson, owing to the fact that he was retiring from Buenos Ayres, he found it necessary to send in his resignation as a member of the Local Committee. This would be a considerable loss to the Company. His position in the city was such that he was of great service to the Company; and he was at all times willing to serve, and at the disposition of the Board, at any cost to himself. It was his (Mr. Pinsent's) pleasure to say that Mr. A. im Thurn, who was for many years in the service of the Company, was about to go out to Buenos Ayres; and he would take Mr. Gibson's place on the Local Committee. Therefore, during these months that negotiations would be pending with the Municipality, the Company would be fully and properly represented on the Local Committee.

Mr. JAMES ECCLES seconded the motion, which was cordially passed.

Moved by Dr. TURTLE, and seconded by Mr. BENNETT, a hearty vote of thanks was also passed to the Chairman and Directors.

The Chairman's acknowledgment concluded the proceedings.

SOUTHAMPTON GAS COMPANY.

The Half-Yearly Ordinary General Meeting of this Company was held last Wednesday, in the Offices, Ogle Road, Southampton—Captain A. J. CORSE SCOTT, J.P., the Chairman, presiding.

The SECRETARY (Mr. E. W. H. Eady) having read the notice convening the meeting, the report of the Directors for the six months ending Dec. 31 last was taken as read. They stated that the amount available for distribution was £16,970; and they recommended the payment of maximum dividends amounting to £13,065; leaving a balance of £3915 to be carried forward. There was an increase of 23,767,000 cubic feet in the quantity of gas sold during the six months, compared with the December half of 1906. The number of consumers on the prepayment meter system increased to 15,300; being an addition of 500 during the half year; and nearly 200 gas-steam radiators had been fixed.

The CHAIRMAN, in moving the adoption of the report and accounts,

said he was again pleased to be able to congratulate the stockholders on a very prosperous and successful half year. They would see from the accounts that the profit available was £16,970; and after paying the maximum dividends, the undivided balance to be carried forward was £3915. The reserve fund account now amounted to £48,840. He remembered when it stood at £20,961 only; so that it had more than doubled since then. The Directors wanted, however, to see the reserve stand at £50,000; and to attain this object they recommended that £1159 should be placed to the fund, and that the balance of £2756 should be carried forward. Perhaps the stockholders were not aware that the present half-yearly meeting was an especially interesting one, as it marked the "Diamond Jubilee" of the formation of the Company, which was incorporated by Act of Parliament in 1848. For sixty years the Company had, he might safely say, been a beneficial influence in the town and neighbourhood; and he could not help expressing some pride in saying that maximum dividends had been paid to the shareholders throughout the whole of this period. These remarks, of course, applied to the past; but there was every reason to anticipate a similarly successful record in the future. As the demand for gas increased, the Company took their mains into the outlying districts. The latest extension had been in the direction of Netley, where gas was wanted, and the Directors desired to meet the want. Considerable demand for gas had been expressed by the inhabitants of Lyndhurst. The Company were very desirous of satisfying this requirement, and the Directors hoped before long to be in a position to do so. Hitherto the difficulty of obtaining land for the site of a distributing gasholder half way between Southampton and Lyndhurst had proved an obstacle to the carrying out of this extension. The Directors, however, were still negotiating for a suitable site; and they had reason to hope that before long they would obtain one. The question of the price of coals had occupied their attention. The Coal Mines (Eight Hours) Bill now before Parliament would, if passed as introduced, inevitably increase the cost of coal; and this could not but be a source of anxiety to all gas companies. Recent remarks of the Home Secretary, however, gave some hope that the Bill as drafted would be modified. The stockholders would be glad to hear that the Directors had been able to make a contract for the supply of coals with their present contractors for the ensuing year at a price which must be regarded, under all the circumstances, as very satisfactory.

The DEPUTY-CHAIRMAN (Mr. J. C. Moberly, M.A.) seconded the motion, and it was carried unanimously.

The maximum dividends having been declared,

On the motion of Mr. A. W. OKE, seconded by Dr. R. BENCRAFT, J.P., a vote of thanks was cordially passed to the Secretary, Resident Engineer and Manager (Mr. S. W. Durkin), Consulting Engineer (Mr. Joseph Cash, M.Inst.C.E.), and the official staff, whose work was considered to have helped to make the Company so great a success.

Mr. EADY returned thanks for the renewed expression of confidence in his staff, to whom it would, he said, be a great source of pleasure to know that the vote had been unanimously passed. He regretted to have to return thanks on behalf of the Manager and his staff as well as his own; but, unfortunately, Mr. Durkin was suffering from illness, and was unable to be present.

Mr. CASH, in response, said he happened to be connected with other gas companies, and he could safely say no company was in a firmer or better position than that at Southampton. All the works were in good order; and he could assure the stockholders that everything was in excellent trim. With regard to the supply of gas to Lyndhurst, difficulties which stood in the way had been overcome; and now he hoped there would be no further obstacle to giving the village, which was growing rapidly, an adequate supply of gas.

The proceedings then closed.

THE RECENT ACCIDENT AT DORKING.

At the last Meeting of the Dorking Rural District Council, a letter was read from the Coroner, Mr. G. F. Roumieu, referring to the evidence given at the inquest on George Young, who was killed by being run over after passing a trench which had been made in a road by the Gas Company (*ante*, pp. 243, 299). He said the Jury wished him "to bring the matter to the attention of the Council, as they considered there was considerable negligence on the part of the Gas Company in opening the road to such an extent, and so diverting the traffic as to make it dangerous for vehicular traffic." The Clerk (Mr. W. J. Down) said that from inquiries which had since been made, it appeared that, as a matter of fact, the accident did not occur as a result of the opening of the trench. The deceased had his van well past it, and out on to the main road; and it was only when he started his horse again on the hard road that he was knocked down, and was unfortunately run over. It could not, therefore, be attributed to negligence on the part of the Company; and it was only owing to the narrowness of the road that the work was carried out as it was. At the inquiry, there was no one really present on behalf of the Company who was in a position to bring out the real facts. He himself (as Secretary to the Company) had no notice of the inquiry. It seemed to him that the point which concerned the Council was whether the work was carried out in a manner to cause the least inconvenience possible to the general public. Notice of the Company's intention to open the road was, of course, given to the Council in the usual way. The Surveyor (Mr. W. Rapley) produced a plan, showing where the accident really happened, and explained the circumstances to the Council. The road, he said, was 17 ft. 10 in. wide at the spot; and he was of opinion that the Company had allowed more passage on the side of the road which they left undisturbed than they could have done on the other side. His opinion was that the Gas Company did the best they could. After some further remarks, the Chairman (Mr. F. D. Grissell) said he could not see that the Gas Company were to blame. If the Council were to employ men to supervise the opening of the roads when it was required to be done by the gas, water, telephone, or other public companies, they would need a very big staff. He suggested that they should reply to the Coroner regretting the accident, and stating that, having fully considered the circumstances, they were of opinion that the Gas Company did the best they could under the circumstances.

EXAMINATIONS IN GAS ENGINEERING AND SUPPLY.

The City and Guilds Question Papers.

Our readers are aware that the examinations in "Gas Manufacture" which have for some time been conducted by the City and Guilds of London Institute have this year been held on two branches of the subject—"Gas Engineering" and "Gas Supply." The Examiner for the former was Mr. A. F. Browne, the Superintendent of the Vauxhall Station of the South Metropolitan Gas Company (who will now, as already announced, relinquish the position in favour of Mr. W. Doig Gibb, of Newcastle), and for the latter Mr. J. H. Brearley, of Longwood. The examinations in "Engineering" were held on the 2nd inst.; those in "Supply" on Saturday last. The following were the questions set by Mr. Browne; the candidates being directed to confine themselves to one grade only, and not to attempt to answer more than eight of the numbered questions and only one of the alternative questions in the four hours allowed.

HONOURS GRADE.

1.—Write down a formula for calculating the theoretical elevation of temperature when 1 lb. of carbon is burned to CO_2 in just sufficient quantity of atmospheric air for its complete combustion (not preheated), assuming the mean specific heat of CO_2 and N to be 0·245. Give reasons for the wide difference between the figure so obtained and the actual temperature in the combustion chamber of a retort setting as indicated by pyrometer.

2.—State modifications in gas and bye-products resulting from coal distillation in bulk (oven or chamber settings), or in filled retorts of more ordinary dimensions, as compared with the results of the usual carbonizing practice. To what causes would you attribute these differences? Or, describe any system of vertical retorting in actual work, whether British or foreign, continuous or intermittent, stating advantages claimed.

3.—State, in order of their importance, the sundry processes comprehended under the term "coal-gas condensation"—*i.e.*, define the duty of the condenser. Describe that form of the apparatus with which you are best acquainted, showing its suitability for each separate purpose, and suggesting improvement where you think it unequal to the particular duty required. How, if designing a condenser for a specified volume of coal gas of given initial and final temperature, would you proceed to make a quantitative estimate of the British thermal units to be removed?

4.—Mention methods employed for high-temperature measurement in the gas industry, and specify the most suitable instruments for ascertaining the temperature of (1) combustion chamber and flues of retort setting, (2) coal undergoing carbonization, (3) incandescent mantles, or, (4) give examples of the industrial use of town gas other than for power and light. Specify recently-devised methods and means by which the locally concentrated combustion of mixtures of gas and air results in the rapid attainment of very high temperatures for industrial purposes.

5.—Specify the forces acting upon a floating gasholder under normal conditions, showing that they are in equilibrium—*i.e.*, that they balance one another—so long as the vessel is plumb. Show that such equilibrium is unstable, necessitating guide-framing or other devices to enable the holder to maintain the perpendicular when subjected to external forces such as wind or snow. State the minimum ratio of depth to diameter permissible in the design of gasholder shells, giving reasons. Give a usual ratio of rise of crown to diameter.

6.—Assuming an average yield of 6 lbs. of NH_3 per ton of coal carbonized in gas-works, state the quantity of sulphate obtainable, writing down its formula and the chemical equation showing its formation. Describe the construction and duty of each piece of apparatus in a modern sulphate plant, assigning to it its proper position in the series. Illustrate by sketches. Or, state the theory of formation of blue salt in sulphate manufacture recently propounded by the Chief Inspector of Alkali, &c., works. Describe one of the following methods of dealing with the waste gases from sulphate works: (1) Claus kiln, (2) combustion and neutralization.

7.—Calculate the consumption in a gas-engine of 30 per cent. heat efficiency of each of the following gases per brake-horse-power-hour—viz., gases of 600, 300, and 150 British thermal units calorific value respectively. Assuming the volumes of air required to be respectively 10 to 1, 3½ to 1, and 2 to 1, calculate the requisite cylinder capacity (piston displacement) for each mixture at a speed of 160 revolutions per minute in a 150-H.P. gas-engine. Or, enumerate the chief competitors with town gas for power purposes. Specify certain advantages possessed by the gas-engine as compared with other prime movers. How does its heat efficiency compare with that of the best steam-engines? Contrast the convenience, &c., of taking gas from public mains for power purposes, with the drawbacks attaching to private gas-making units.

8.—A gasholder station situate half-a-mile from the gas-works is connected thereto by three mains, respectively 30, 24, and 24 inches diameter, and approximately of equal length. State how friction will vary in these mains—(1) when the pressure of the gasholder is doubled, (2) when the make of gas is doubled, (3) when 30 per cent. of carburetted water gas of ·58 specific gravity is mixed with coal gas of ·4 specific gravity, as contrasted with coal gas alone.

9.—State usual areas and capacities of plant for condensation and wet purification of a maximum make of 5 million cubic feet of coal gas per 24 hours, and show how you would divide up or sectionize the apparatus in order that the minimum make might be condensed, washed, and scrubbed in about equal proportion to the maximum. Give reasons for and against such method of works design. Or, calculate the dry purifying area for a maximum make of 5 million cubic feet of coal gas per diem, employing the constant 0·4. Find, by extracting the square root of half the area, the length of side of each vessel for two streams of four boxes each. Assuming the area of gas-way through

the material to be one-third the area of the vessel, and that the thickness of the material per box is 3 feet, find the time-contact of gas with material in passing through four boxes per stream; or, as an alternative, calculate the velocity of flow of gas in the 20-inch inlet-main to each stream in lineal feet per minute.

10.—Describe the standard unit of measure prescribed by Parliament for the sale of gas by meter. Give a list of the primary and secondary pieces of apparatus specified by authority for testing the measurement and registration of meters. Or, sketch and describe Thorp's rotary meter.

ORDINARY GRADE.

1.—Specify, under the following heads, the carbonizing plant with which you are most familiar:—(*a*) Retorts—shape, dimensions, and number per bed and per furnace; (*b*) method of firing and grate area per mouthpiece; (*c*) weight and duration of charge; (*d*) maximum working temperature; (*e*) output of gas per retort per 24 hours; (*f*) method of charging and discharging. Or, describe very briefly any mechanical stoking plant or inclined-retort system with which you are acquainted, and state the advantages (other than labour saved) which you believe it to possess as compared with hand stoking.

2.—What difficulties and disadvantages would you hope to overcome, and what improvements in working results would you expect to secure, by the adoption of retort-house governors? Sketch such a governor in sectional elevation, and explain its action.

3.—Show that two-stage combustion of carbon is indispensable to the economical working of a carburetted water-gas plant, but wasteful in the case of a blue water-gas installation; and describe the methods and means by which the greatest fuel economy is secured in each process.

4.—Define the forms in which heat is present in gas leaving the hydraulic main, and explain why the quantity of heat to be removed by the condenser is much greater between 140° and 100° Fahr. than between 100° and 60° Fahr. Mention several ways in which heat is carried from, or dissipated by, the condenser. Describe shortly that form of the apparatus with which you are most familiar.

5.—Sketch in transverse section, and explain the working of, Beale's exhauster (rotating block type), or Waller's three-blade exhauster.

6.—Describe the internal fittings of an oxide purifier. Sketch any modification of recent date, and state advantages claimed. Mention simple precautions to be observed in the preparation of the material, in charging the vessel, and in putting the box into action. Or, sketch, both in transverse and in longitudinal section, a rack-and-pinion or worm-and-rack slide-valve; indicating by letters and defining its component parts, especially those upon which its tightness depends. Sketch also a purifier water-valve in sectional elevation.

7.—Briefly describe apparatus and reagents requisite for collection and analysis of fuel gas from an ordinary gas-works producer having water-sealed ashpan, and working under natural draught. State the calorific value of the gas, and the percentage by volume of CO, H, CO_2, and N which you would expect to find both before and after combustion, together with the volume of secondary air required.

8.—Upon what resistances to the bursting pressure of the contained water does the stability of gasholder tanks depend—(1) when built in the ground of concrete or masonry, (2) when built above ground of cast iron or steel? Define four purposes served by the water in gasholder tanks. Or, state the invariable shape of the modern gasholder and its crown. In what plane only may it be free to move? What means are adopted to ensure this? What external forces must it be able to withstand when afloat? How would its buoyancy be modified if filled with a gas heavier than air? Upon what factors does its pressure depend?

9.—What are the limits of error in meters permitted by the Sale of Gas Act, and how are they apportioned between buyer and seller? By what mechanical devices are these limits controlled in the ordinary type of wet meter? Sketch and explain. Or, by what means is accuracy of measurement maintained in the works station meter? Assuming the meter to register correctly, mention three sources of error for which correction to standard volume must be made. Suggest a means whereby errors due to friction of meter and weight of gasholder may be conveniently included in the correction.

10.—Contrast the principles of the combustion of gas in luminous and in non-luminous flames. Show that the efficiency of the latter agents for lighting purposes is not solely dependent upon the calorific value of the gas consumed. Prove that the combustion of town gas both promotes wholesomeness of air in living-rooms and is powerfully conducive to natural ventilation. Or, specify three systems of public lighting by gas, and give a short description of one.

In the Honours grade, 39 marks were given for Nos. 2, 4, 7, and 9, and 36 for the others. In the ordinary grade, the higher number of marks was given for Nos. 1, 8, 9, and 10.

The following were the papers set by Mr. Brearley on the subject of "Gas Supply," the conditions being similar to those laid down for the other branch.

HONOURS GRADE.

1.—What are the principles which govern (*a*) the construction of the mixing-tube of an inverted incandescent burner, including the size of its orifice, and (*b*) the shape of the inverted mantle? Explain the difference in the form of an inverted mixing-tube and mantle when compared with the mixing-tube and mantle of an upturned burner.

2.—Describe two methods of governing the mixture of gas and air to the cylinder of a gas-engine. Which do you consider the most satisfactory, and why?

3.—What are the relative merits of lighting street-lamps by (*a*) torches (*b*) gas bye-passes, (*c*) flash-lights, and (*d*) automatic apparatus?

4.—Upon what constructional points does the economy of a circulating water-heater depend? Should the outlet be connected to a flue; and, if so, what provision is necessary to avoid waste of heat by excessive draught? How many gallons of water should a circulating heater raise 30° Fahr., consuming gas of 600 British thermal units gross, at the rate of 30 cubic feet per hour?

5.—What precautions are necessary when fixing and adjusting gas switch installations to ensure satisfactory results? Describe generally how you would carry out an installation in a church, and what provision you would make for extinguished bye-passes.

6.—Assuming the following heating appliances have been fixed at a consumer's premises—(*a*) a gas-steam radiator in work-room, (*b*) a register (basket) gas-fire in dining-room, and (*c*) a canopy gas-fire (with flue outlet) in bed-room—what, respectively, are the points upon which the consumer should be informed, in order to secure hygienic efficiency at a minimum cost?

7.—In what way does compression of gas affect the heat from, and the temperature of, a bunsen flame? How is the calorific value of gas ascertained? Or, discuss the relative merits of compressing (*a*) gas, (*b*) gas and air, and (*c*) air only, in high-pressure installations.

8.—Describe fully the process of laying three 12-feet lengths of 8-inch gas-main, joints being made before dropping the main into the trench. What tools are necessary for the work? Or, what tests would you apply to demonstrate the relative efficiency of various forms of lead joints in gas-mains, bearing in mind common causes of leakage at such joints?

9.—In a workshop, the greatest light intensity is required at a point 18 inches from the front of the bench, and an equal distance above it. Show by sketches in what position you would fix a low-pressure inverted burner of the "Nico" type, so as to obtain the greatest efficiency, and state the type of reflector you consider best for the purpose. Or, what proportion of the light-rays from an upturned burner are radiated above the horizontal, and how is this ascertained? What means are adopted in street lighting for ensuring the greatest lighting efficiency on the road surface?

10.—By what methods may the pressure thrown by the gasholders be raised for the purpose of reinforcing the supply to the district mains or the distributing governors. Describe one of such methods as applied in practice. Or, a 6 inch gas-main is increased in length from 1200 yards to 3600 yards. What increase in the initial pressure of 1 inch is necessary to secure the same discharge of gas, and upon what formula is the answer based?

ORDINARY GRADE.

1.—Of a service 100 yards long, the first 50 yards are laid with a total fall of 5 feet, and the remaining 50 yards with a rise of 8 feet. What provision is necessary to ensure a satisfactory supply? If the pressure at the main is 2½ inches, what will it be at the end of the service, ignoring frictional losses?

2.—Enumerate six distinct causes of insufficiency of supply to residences, and the remedies to be applied in each case.

3.—Describe fully how, on completion, you would test for leakage (*a*) the soldered joints of a gas-meter, (*b*) the joints of a 6-inch gas-main, and (*c*) the soldered joint of an ordinary gas-bracket. State how the bracket is usually fixed, and show, by simple sketches, the tools used and the fittings required to complete the work.

4.—What are the chief points to be observed in the working of a gas-engine, if economical running is to be ensured?

5.—If you were called to a consumer's residence to remedy a faulty fire-clay "fuel" (asbestos) gas-fire, how would you proceed with the work? What precautions are necessary in arranging the "fuel," in order that freedom from smell and high radiation efficiency may be secured.

6.—Explain, and illustrate by simple sketches, what devices or means are employed in the construction of inverted burners for dealing with the products of combustion so as to prevent (*a*) deposition of soot on the mantle, (*b*) commingling with the primary air supply, and (*c*) impingement on the burner fittings or pendants. In each case give reasons why the devices are necessary for efficient results. Or, explain the functions of (*a*) the ejector, (*b*) the cone deflector, (*c*) the mixing-tube, (*d*) the wire gauze or enamel burner-head, as applied in incandescent burners.

7.—How would you carry out the operation of fixing a T-branch in an existing gas-main (*a*) with and (*b*) without stoppage of the flow of gas through the main? Or, describe two forms of low-pressure gas-main joints, and explain their relative advantages and disadvantages.

8.—Describe fully the working of one form of slot mechanism as applied to a dry meter. Is there any difference between the slot attachments of dry and wet meters, and, if so, in what respect? Or, describe the construction and working of a dry meter, with special reference to the mechanism by which the gas is registered. What are the chief points upon which accuracy of registration depends?

9.—Describe fully one form of wind and storm proof lantern, and show, by sketch in sectional elevation, how the wind-proof efficiency is effected? Or, give two methods by which the air of combustion is introduced into street lanterns, and discuss the merits of each.

10.—In applying ventilating devices to living-rooms, what general principles should determine the position of air inlets and outlets? In what way may gas be utilized to remove products of respiration above the breathing level?

In both grades, 39 marks were given for Nos. 6 to 10, and 36 for the rest.

The Polytechnic Question Papers.

The following were the questions set at the Polytechnic, Regent Street, where the classes in "Gas Manufacture" are conducted by Mr. Walter Grafton, F.C.S., at the examinations held on the 16th ult. In this case only six questions in each grade were to be attempted.

HONOURS GRADE.

1.—Sketch, in front elevation, a setting of ten retorts with fittings, showing the position of the combustion chamber and the furnaces feeding-door. Assuming that 12½ per cent. of fuel is used to heat the retorts, what percentage of the coke per ton of coal carbonized should be left for sale of (*a*) good coke (*b*) breeze.

2.—Illuminating gas, having 545 B.Th.U. net, is supplied to a geyser under the following conditions. What is the percentage of heat utilized? (Inlet water temperature, 50° Fahr.; outlet water, 109° Fahr.; quantity heated, 16 gallons, with a gas consumption of 24 cubic feet.)

3.—How and to what extent is the volume of gas affected by temperature and pressure? How do these physical facts explain the effect of a ventilating stove in the warming and ventilating of a room?

4.—A room 16 ft. 8 in. by 12 ft. by 10 ft. is freshly aired, after which three persons occupy it for three hours, there being, in addition, two gas-jets, each burning 2 cubic feet an hour. Assuming no ventilation, and that a cubic foot of gas in burning yields 0·53 cubic foot of carbonic acid per hour, find the amount of carbonic acid per 10,000 volumes of air at the end of occupancy.

5.—State the area necessarily required per set of four purifiers to purify gas from ½ per cent. of H_2S by the use of oxide of iron. What effect follows the adoption of this *versus* thick layers of oxide on the sieves? Give the percentage of free sulphur usually contained in well-spent oxide.

6.—Describe a continuous process of manufacturing sulphate of ammonia. Which is the most efficient method of heating the liquor, by indirect or direct steam? What is the nature and strength of the acid used, and what quantity of the acid per ton of sulphate produced is considered economical?

7.—How would you detect stoppage in a main when its locality cannot be determined by observing the lights? A main passes 10,000 cubic feet of gas per hour under 2·2 inches pressure. What volume will be delivered when the pressure is increased to 3·5 inches?

8.—Assuming that a gas-engine consumes 8500 units per brake horse-power-hour, calculate its heat efficiency. What do you understand by the term "horse power of an engine?"

ORDINARY GRADE.

1.—Give a sketch, with description, of a setting of seven retorts, with fittings, worked on the generative system, and explain the action of this kind of furnace.

2.—What is the object of the retort-house governor? Can the same result be obtained without its use?

3.—Explain fully what you understand by the term "unaccounted-for gas," and classify the items of which it is made up. Below what figure should it be kept?

4.—What are the advantages and disadvantages of a battery condenser, and how are the liquid products separated from the gas?

5.—In practice, we find both luminous and non-luminous burners employed for the fuel applications of gas. Why is this? Explain each burner, stating the average efficiencies.

6.—Describe and illustrate by sketches a means of maintaining the water-line in a wet meter. A meter registers 15,000 cubic per hour at 80° Fahr. and barometric pressure of 30·3 inches. What is the corrected volume at N.T.P.?

7.—Explain the operation of "laying on" a gas supply to a house as far as the meter.

8.—Fully describe a rotary washer-scrubber and what products are removed from the gas by its use.

PUBLIC LIGHTING OF TUNBRIDGE WELLS.

Control Again Given to the Lighting Committee.

Some months ago, the Tunbridge Wells Town Council passed a resolution transferring the supervision of the public lighting from the Lighting Committee (who have control of the municipal electricity undertaking) to the Watch Committee. This step displeased the Mayor, who was absent at the time, and who is Chairman of the Lighting Committee; and in a letter to the Council he complained of what had been done. When the Council met last Wednesday, Mr. Tylor moved that the supervision of the lighting of the borough be re-transferred to the Lighting Committee; and this was agreed to.

In proposing his resolution, Mr. Tylor said the town had a very large sum of money invested in the electricity undertaking; and he was pleased to see that, so far, a profit had been shown on it. He held it to be their duty to get as much business as they possibly could for their own undertaking; but immediately they brought forward a motion to secure more business, they were met by a move to transfer the power of deciding the matter from the Lighting Committee to another Committee, who he maintained had no exceptional knowledge of the subject. Originally the Gas Company did the whole of the lighting in the town. When electricity was adopted, the Gas Company retained a portion of the lamps, and had also secured a certain proportion of the additional lamps erected since. It had always been the custom in these matters, in consideration of the large number of lamps given, that the price was reduced. He had gone carefully into the figures, and maintained that, if more lighting was provided by electricity, it would result in a very considerable profit, which would go into the pockets of the ratepayers, and not those of the gas shareholders. There might be some little feeling that they should be generous to the Gas Company, and let them have as big a share of public lighting as hitherto. He did not hold that to be so, but believed that their first duty was to look after the undertaking in which the ratepayers had invested their money.

On the other side, Alderman Ryder, who moved the motion at the previous meeting placing the control in the hands of the Watch Committee, stated emphatically that it had not been brought forward to steal a march on the Mayor, or in any spirit of disrespect to him. Until 1894 the lighting was in the hands of the Watch Committee, and the sin of grabbing other people's work did not rest with that Committee. When he made the motion previously, he had nothing but compliments for the Committee and the staff, and had great respect and admiration for the way they had brought the undertaking from its inception to its present successful position. He made his proposition on the score of commercial morality, believing it was not right that the Lighting Committee should have in its bands the control of public lighting.

Mr. Wesley Smith remarked that they were almost forced into the action they took, and in that action they had no feeling of discourtesy. There had been a gradual increase in the proportion of public lighting by electricity, as compared with gas, as could be seen by the abstract of accounts. It was proved at the former meeting that the town was paying rather over a penny rate more than if the whole place was lit by incandescent gas. The question of economy was involved in this fact. He thought people would not have so much cause for complaint if the light was more efficient; but it was generally admitted that incandescent gas as a public illuminant was superior to electric glow lamps. Public lighting should be charged at cost price, or slightly over. It was evidently not so in this case, because it had been suggested that without the public lighting the undertaking would be wrecked. This proved public lighting must be a source of large revenue; and, in fact, it seemed that the public lighting was not done at anything like cost price. For electric glow lamps, £3 19s. was charged, compared with £3 9s. 4d. by the Gas Company. There had been no reduction in the price of arc lamps, which at £21 each were a most expensive form of lighting. They were told that if the 200 further glow lamps were connected, they would be charged at the same price as the gas lamps—viz., £3 9s. 4d. each; but there was no tender asked of the Gas Company to see if they would give a supply at a still cheaper rate. It was left to the Gas Company to find out what was going on; and they then actually sent in a tender at something like £3 7s. 6d. per lamp. This led him to think that if they were to hold the scales evenly between those ratepayers who were consumers of electricity and those who were not, the public lighting must be in the hands of an independent Committee. If a large profit was to be made out of public lighting, private consumers would perhaps get their light cheaper, but at the expense of the general body of ratepayers.

Mr. Hyde said that so far as he could read the figures, the Lighting Committee, to show a profit, had charged the town a shilling in order that its balance-sheet might show a profit of sixpence; the town being the net loser to the extent of the sixpence. Take the case of lighting per mile, they would see that by electric glow lamps the price would be £3 9s. 4d., or a total of £115. The same lighting by gas would be £83; so that the mile of road cost £32 more than it would do if gas were used. The gross loss to the town was £32 per mile; but they must consider the profit the Lighting Committee made out of the £115. It seemed that the profit on public lighting worked out at just 14 per cent. Therefore, out of the £115, the sum of £16 represented profit. With regard to the question of the 200 lamps proposed to be transferred at a cost of £3 9s. 4d. each, the total expenditure would be £693, which, at a profit of 14 per cent., returned £95, which sum would be shown in the balance-sheet of the Lighting Committee. The Gas Company said if they were allowed to light the lamps by gas they would save the town a net sum of £145, or, under a three years' agreement, £215. The effect of all this was that, in order to put a profit of £95 in its balance-sheet, the Lighting Committee lost the opportunity of saving either £145 or £215. He knew it had been said that the Electric Lighting undertaking was paying; but whatever views they took with reference to public lighting, they must bear in mind that the concern ought to be made to pay in a fair and legitimate manner. He suggested that, in order to make the undertaking pay, it had been receiving that most wasteful of all payments—an indirect subsidy. Indirect subsidy of this kind was a most dangerous policy, because it rendered it so difficult to show how far they were paying from the rates of the town for the subsidy. The question really was, Did the undertaking pay, or did it not pay? According to the balance-sheet of last year, there was a net profit of £1415, after paying sinking fund and interest charges. This was made out of a gross revenue of £14,000, and showed a profit of some 10 per cent. Did they consider that this 10 per cent. profit was a reasonable one? There was no need for it so far as the ratepayers were concerned.

Several other members took part in the discussion; the Mayor maintaining that the lighting should go back to the Lighting Committee, whose undertaking had progressed satisfactorily, and was now in a position to fight the opposition on its merits. It was just possible that in the future they would be able to provide the electric light at a cheaper rate. If a profit was made, it was clear that the ratepayers benefited.

New Issue of Metropolitan Water Board "B" Stock.—In the last number of the "JOURNAL," it was mentioned that the Metropolitan Water Board were about to issue an additional £1,500,000 of "B" stock. The tenders were opened at the Bank of England on Thursday, and amounted to £1,913,300, at prices varying from £92 to £90 (the minimum). Tenders at £90 os. 6d. will receive about 65 per cent. of the amount applied for; those above this figure being allotted in full. The average price obtained for the stock is £90 2s. 5·95d.

Sales of Shares.—At the Central Exchange Hotel, Newcastle, last Tuesday, Messrs. Henry B. Slee and Sons offered for sale by auction 1200 cumulative £10 preference shares (5 per cent.) in the Annfield Plain and District Gas Company; and a number of them were sold at par. On Wednesday, Messrs. Morris and Place sold some Nottingham Corporation gas annuities (£3 5s.) for £89 15s. and £90, and some water annuities (£3 10s. and £1 7s.) for £98 12s. 6d., £38 5s., and £38 10s. At the Bell Hotel, Bromley, last Thursday, Messrs. Baxter, Payne, and Lepper sold £5000 of "A" ordinary stock of the Bromley Gas Consumers' Company, being part of the additional capital authorized by the Company's Act of 1902; and it realized £5916 15s.

The Troubles of Gas Inspectors.—At Stratford Police Court, on the 2nd inst., Henry Boyce, living at Woodford, was summoned by the West Ham Gas Company for unlawfully connecting a gas-pipe with a meter without giving notice in writing. It was stated that the Company had had trouble with defendant, who took no notice of a demand for an account, and the gas was disconnected. Two days later he wrote: "I have reconnected my gas-meter with my gas-pipe. I have instructed my dog—an Irish terrier—promptly to sample the legs of any officials who may enter my house for the purpose of making any examination of my meter. . . . This dog does not require any setting on—it will be the setting off again which in my absence may be attended with difficulty." He warned the Company not to cut off the supply again. Defendant said he had acted in this way "in order to protest against these people, who had a monopoly, not treating their customers decently." The Bench imposed a fine of 10s. and 4s. costs.

ILKESTON GAS DEPARTMENT.

The Past Year's Progress.

At the Meeting of the Ilkeston Town Council last Tuesday, the Gas Committee presented their report for the year ending the 31st of March. They expressed their pleasure in recording that the work of the Gas Department progressed very favourably. During the above-named period, the quantity of gas made was 108,182,200 cubic feet—an increase of 4,465,800 cubic feet on the year 1906-7—while the quantity of coal used was 10,980 tons, against 10,514 tons before. The income for gas increased from £12,304 to £13 290, due mainly to the slot-meter consumers, who now provide about half the revenue. Residuals produced £4332, compared with £4057; a good increase in coke prices being unfortunately reduced by a fall in tar and other products. The cost of coal advanced from £4765 to £5870, partly due to the increased tonnage, but chiefly to the higher prices which had to be paid. The cost of general repairs to works, plant, and fittings was about the usual figure; the various appliances being maintained by the Engineer and Manager (Mr. F. C. Humphrys) in as efficient a condition as possible. The total expenditure amounted to £10,684; and as the income was £17,801, the gross balance at the close of the year stood at £7117, against £6368 before. Owing to this particularly satisfactory result, it is possible to make the usual contribution to the rates, provide for depreciation and sinking fund, and return to the suspense account the sums taken from it in several past years. The Committee pointed out that the department, in addition to having more to pay for the raw material, are committed to a scheme of considerable extension; and it is not possible that the whole of the plant will be fully productive for the next few years. Some parts of the new works also must of necessity be provided for out of revenue. The increase in consumers continues satisfactory. There are now 5036, or 265 more than last year; and 3861 are slot-meter customers. The number of cookers is 1634. The use of gas for motive power is rapidly increasing, and there are 15 engines, equal to 216 H.P., now supplied at the special power rates introduced this year. The report was adopted.

TIVERTON CORPORATION GAS SUPPLY.

Local Government Board Inquiry.

An inquiry was held at Tiverton last Tuesday, by Mr. R. H. Bicknell, M.Inst.C.E., one of the Inspectors of the Local Government Board, into an application by the Town Council for authority to borrow £4000 for the purposes of the gas undertaking.

The Town Clerk (Mr. C. M. Hole) explained that during the past few years there had been a great increase in the demand for gas, and that the output had risen from 30 million cubic feet in 1905 to nearly 41 millions for the year ending in March. This increase had been progressive; the make of gas having been 34 million cubic feet in the year 1905-6, and 36 millions in 1906-7. They managed to get through the last winter; but the Town Council felt strongly that they must now have increased storage. A contract was provisionally entered into with Messrs. Willey and Co., of Exeter, for a telescopic gasholder, meter, station governor, steam-engine, boiler, and pump, for £3026; and foundations and contingencies made up the remainder.

Mr. Clark Jeffrey (the Engineer and Manager) submitted the plans, specifications, estimates, &c.; and various questions on technical details having been answered,

The Inspector expressed himself as satisfied, but remarked that it was obvious, in the face of such an increased demand for gas, that the retort capacity would have to be increased shortly.

Mr. R. S. Loosemore, a ratepayer, after informing the Inspector that he was not opposing the loan, reviewed the history of the gas-works since they became the property of the Corporation. He said the old works were valued at £18,000, but the Council chose to pay £20,000 for them; and with the outlay of another £2000, they put them into a satisfactory state. He thought it desirable to know what the works had actually cost.

The Inspector: The total indebtedness on the works is £15,670. You have paid back in various instalments £12,570; and the total amount the works have cost is therefore £28,240.

Mr. Loosemore then dealt at some length with the Council's electric lighting schemes, and pointed out that these and the Provisional Order had cost the ratepayers £1000—money actually sunk. Several firms had made application to the Council with regard to installing electric light; and should one of them start a rival lighting project in the town, it would mean a serious decrease in the gas-works output, and any loss at the works would have to be made up by the ratepayers. He asked whether the new loan could be justified in the face of the high rates, the tendency of Imperial taxation to increase, and the probability of a rival light.

The Inspector remarked that Mr. Loosemore appeared to suggest that the Corporation were to lie down and do nothing for fear of someone bringing the electric light.

Mr. J. Siddalls (the Borough Surveyor) said the price of gas was 3s. 6d. per 1000 cubic feet now, against 4s. 1d. when the works were bought, in spite of the increase in the cost of coal.

Mr. J. Thorne (the Chairman of the Lighting Committee) said he should like to point out that two years ago they handed over in relief of the rates £613 from the profits of the gas undertaking.

The Inspector expressed his gratification at the presence of ratepayers who displayed an interest in the subject of the inquiry. It was matter for regret that such inquiries attracted so little attention in many towns. He said he believed the figures before him to be correct, and showed a very considerable growth in the gas undertaking; and unless the plant was increased the output would be limited. As to the price paid for the works being £2000 more than the valuation, corporations nearly always had to pay more.

Mr. A. Loosemore contended that the figures given did not go far enough back, for in March, 1903, there was not sufficient profit to meet standing charges, and £400 had to be taken from the reserve fund. Mr. Thorne had spoken of £613 being handed over in aid of the rates, whereas this sum was only paid into the district fund to clear off the money sunk by the Council over their electric light schemes. He asked why the Council wanted to borrow £4000, when the papers stated that a contract for the whole work had been accepted for £3026—nearly £1000 less.

The Inspector explained that £435 was for foundations, &c., and the remaining £539 for new mains.

Mr. Loosemore pointed out that part of the new mains was intended for a very poor quarter of the town.

The Inspector remarked that slot-meters were highly profitable in most places.

The Manager explained how a 6-inch main was to take the place of the present inadequate 2-inch one. He added that he predicted 10 per cent. increased output for five years, when they would have reached about the limit, and then there might perhaps be a drop of 5 per cent. for a year.

The Inspector was thanked for the way in which he had conducted the inquiry, which then closed.

TEIGNMOUTH GAS UNDERTAKING.

Satisfactory Working—Manager's Salary Increased.

At the Meeting of the Teignmouth Urban District Council last Tuesday, the Gas Manager (Mr. J. A. Gray) presented his report on the working of the undertaking in the twelve months ending the 31st of March. It showed that the revenue amounted to £8478, and the expenditure to £7822; leaving a balance of £656. Adding £916 standing over, there was a total credit balance of £1572. Mr. Gray explained that the gross profit had been £2096, and that the difference between this sum and the £656 (£1440) was the expenditure incurred in the liquidation of loans and for interest on them. The gross profit was equal to 13·24 per cent. on the present capital account of the undertaking. The credit balance on the revenue account had increased from £916 on March 31, 1907, to £1572 at the corresponding date this year. The account had a deficit of £1283 on March 31, 1903; and financial betterment amounting to £2855 was therefore shown as the result of five years' working. The total quantity of gas produced was 38,140,330 cubic feet; the average make per ton of coal carbonized being 10,179 cubic feet—an increase of 326 cubic feet per ton compared with the preceding year. Of the total output of gas, 25,735,500 cubic feet were sold to consumers through ordinary meters, 3,449,200 cubic feet to slot-meter consumers, 865,000 cubic feet were used on the works, and 4,596,300 cubic feet were calculated to have been burnt in the public lamps—this being an inside estimate. He returned the unaccounted-for gas at 9·16 per cent. of the output. The average price realized per ton of coke sold was 14s. 0½d.; being 2s. in excess of the receipts the previous year. Having given particulars as to the condition of the plant, which, with the exception of the purifiers, is equal to a 30 per cent. increase in the present output of gas, Mr. Gray concluded by pointing out that the outstanding balances on the loans account now amount to £15,821, against £16,319 on March 31, 1902; that the working position of the undertaking has improved by £2855 in five years, as indicated by the revenue account; and that the price of gas has been reduced by 11d. per 1000 cubic feet, while the public lighting charges have been considerably lowered. He thought it might therefore be reasonably hoped that the future of the Gas Department would tend more and more to the advantage of the ratepayers.

The Chairman of the Gas Committee (Mr. W. J. B. Banbury), in moving the adoption of the report, which contained a recommendation to increase the Gas Manager's salary to £200 per annum as from the 1st inst., referred to the very satisfactory character of the report presented by Mr. Gray. He said it was most gratifying to the Council and to the town generally, as this was the first time the Gas Department had been independent of the district rate during its existence. He went on to compare the present with the past position of the gas-works; quoting some of the figures included in the Manager's report. He also pointed out that when Mr. Gray took office the quantity of gas produced at the works was 24 million cubic feet per annum, whereas it was now 38 millions. They all knew how much more work and responsibility had been thrown upon his shoulders. He (Mr. Banbury) felt there was no need to further enlarge upon the capabilities of the Manager. He might, however, add that he (the speaker) felt a little disappointed that the Committee did not see their way to being a little more liberal in their recommendation. Mr. Bird seconded the motion.

Mr. W. Turpin opposed the increase, and contended that the Gas Committee could not afford it. After what had been done by the Council to improve the works, it was only natural that they should get good results; but they were going to give the Manager a rise in salary which would make him equal to the Surveyor. He thought the Council should stay their hands for a while; and he moved an amendment to the effect that they could not adopt the recommendation. Mr. Knight, who seconded the amendment, also objected to the increase, on the ground that the time was inopportune. Mr. Alsop, in supporting the recommendation, read the letter from the Ratepayers' Association, expressing their gratification at the improved management of the gas undertaking, referred to in the "Journal" last week (p. 313), and said he thought the Council should show their appreciation of what Mr. Gray had done. The directors of a gas company would have readily recognized such service. The Chairman (Mr. F. Slocombe) reminded the members that before the engagement of Mr. Gray the gas-works were carried on at a loss every year; while now the consumers had cheaper gas and there was a profit balance. Consideration was due to the Manager for what he had done.

On being put to the meeting, the motion was carried by seven votes to three; and Mr. Gray expressed his thanks to the Council for their decision. It was also decided, on the recommendation of the Gas Committee, to reduce the price of gas from 3s. 8d. to 3s. 6d. per 1000 cubic feet as from the 30th prox.

ELECTRICITY SUPPLY AT LOUGHBOROUGH.

An Unprofitable Undertaking.

At the Meeting of the Loughborough Town Council on Monday last week, the Gas and Electricity Committee reported that they had considered a statement prepared by the Electrical Engineer showing the probable receipts and expenditure on the undertaking for the year ending March 31, 1909; the estimated deficit being £1729. The Committee, in order to reduce this, considered a suggestion that the sum of £250 should not be set aside as last year for renewals and repairs, but that steps should be taken to ensure against breakdown the plant not already so insured, the cost of which the Engineer estimated at £40. It was resolved that the suggestion should be adopted; and, further, that the Finance Committee should be requested to provide in the estimates for the current year the sum of £1500 to meet the deficiency on the undertaking. Mr. Clemerson said he thought it time they might have reasonably expected the undertaking to be paying its way. Was there any prospect of this? as it was a serious matter for so heavy a loss to continue. It seemed to him that consumers of gas were not only paying for their gas but for other people's electricity. Mr. Wootton remarked that if people would not have electricity the Committee could not supply it, though they had plant ready to do so; and it had to be paid for either through consumers or by the rates. Mr. Bennett said he thoroughly endorsed Mr. Wootton's remarks. It was about time a stop was put to the thing, as they were losing £30 a week. [A Voice: Give it away.] It was about time they shut the plant down, or did something with it. Mr. Barrow said he could not see that the gas consumers were paying for the electricity. He would also point out that the first battery proved a failure, meaning a loss of £1000, and they were compelled to re-erect one out of revenue. So far as the working was concerned, he did not think it was in a bad way. They had every confidence in their Engineer; but, as Mr. Wootton had said, they could not compel people to take current, and unless they had a much larger demand there was very little hope for the undertaking. He anticipated there would be a loss for many years to come.

SOUTHAMPTON CORPORATION WATER-WORKS.

The Appointment of Engineer.

At the last Meeting of the Southampton Borough Council, a letter was produced from the Town Clerk of Poole expressing his Council's regret for the misunderstanding between them and the Borough Council in relation to the question of the position of Mr. W. Matthews, their Consulting Engineer, who recently severed his connection with the Southampton Corporation (see *ante*, p. 110). The Clerk explained that the reluctance to furnish information was not due to a desire to withhold any which might properly be communicated, but through the peculiar circumstances which existed, and which prevented them from giving it without Mr. Matthews' consent. When appointed, he had expressed a desire, which arose from what the Committee understood to be professional feeling, that the terms agreed upon should not be published. The Poole Council certainly never had any intention or desire to avail themselves of Mr. Matthews' services without the entire concurrence of the Southampton Council. They regarded the letter which was sent to the then Mayor as full acquiescence on the Council's part to Mr. Matthews being employed by them; and they had no reason whatever to suppose that the Council were not fully cognizant of the extent to which Mr. Matthews was performing services in pursuance of the consent so given.

In the course of a report presented by the Water Committee, they stated that at one of their meetings it had been decided to recommend the Council to appoint Mr. J. Chalk, of the Water-Works Department, for a period of six months, on probation, Manager of the water undertaking, at a salary of £250 per annum. To this, however, an amendment was moved to the effect that the consideration of the appointment of a Water-Works Engineer be deferred for a period of six months, and that, in the meantime, Mr. W. Matthews be asked to complete the scheme in connection with certain drying plant and subsidiary works for a fee of £75; but it was lost on a show of hands. The adoption of the report having been moved and seconded, Mr. Lewis moved, as an amendment—"That a Water-Works Engineer be appointed, at a salary of £300 per annum, to devote the whole of his time to the duties of the office, and to hold the position during the pleasure of the Council." He said he felt an attempt was being made to keep Mr. Matthews in the position of Consulting Engineer; and, in his opinion, this was inadvisable. He understood that not long ago it was stated there was a sufficient water supply for the whole town, supposing they did away with the Hants portion. It had been hinted, however, that they were supplying to the utmost capacity, and that the question would have to be considered of having further plant. If they were going to appoint Mr. Chalk, it would be impossible for him to carry out new works; and therefore it would be far better to have a qualified engineer to look after their works. Alderman Dunsford seconded the amendment, and it was carried.

The Lisburn Urban Council and the Gas-Works.—At the last monthly meeting of the Lisburn Urban District Council, a letter was read from the Chairman of the Lisburn Gas Company, stating that if the Council thought it would be for the interests of the town that the gas-works should be acquired by them, he would, on hearing to this effect, with any proposal as to terms, be pleased to put the matter before the Company. The Clerk was directed to write to the Chairman, asking to be supplied with copies of the Company's balance-sheets for the past five years, for the perusal and observations of the Council's Gas Engineer.

Cooker Season Dilemma!

Gas Manager:

"What am I going to do about it? My fitting staff is small, and there is now more work on hand than we can cope with, in addition to which Gas Cooker orders are rushing in, which **must** be attended to at once. Shall I advertise for men? The results from this method are always uncertain, and, further, I may only require extra men for a few weeks."

Manager of Wright's "Eureka" Fittings Staff:

"Why not utilize the 'EUREKA' Fittings Staff, and so secure the benefits of trained Stove Fitters without having to engage unknown men, and avoid the unpleasantness of having to dismiss men at the end of the Season?

"We will supply you with Competent Men, and we will provide Trained Canvassers to find you new consumers."

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

On Monday of this week, the Edinburgh and Leith Gas Commissioners met to consider the tenders which had been sent in for the supply of coal and general stores for the year from Whitsunday current. The meeting was held in private. At its conclusion, it was intimated that the Commissioners had agreed to purchase 172,000 tons of coal at an average price which shows a considerable reduction upon the amounts being paid under current contracts. It was also communicated that tenders for general stores were accepted, as was also the tender of Messrs. Scott and Brown, builders, of Edinburgh, for the necessary alterations upon the properties acquired in Waterloo Place for the extension of the offices of the Commissioners. A year ago, the Commissioners, at the end of April, purchased 40,000 tons of cannel, and, on account of the state of the market, deferred the purchase of common coal till a later period of the year. They have bought this time for approximately the whole year. The probability is that they will require more than 172,000 tons, because, in the twelve months ending May 15, 1907, the consumption of coal was 178,524 tons. The balance needed may be made up by purchases in the course of the year, or probably by increasing the admixture of carburetted water gas. If by purchases of coal, there is the contingency to be taken into account of the possibility of the illuminating power of the gas being reduced in the course of the year, which would, of necessity, greatly influence the decision of the Commissioners as to the kind of coal they would purchase. The business this year has been gone about with much greater reticence than usual; the average price paid not having been disclosed, which used to be the case.

The gas industry in Scotland has, since I have known it, been happily free from the stain of crime of any magnitude. A very bad case is, however, recorded this week, in that of Robert M'Vicar, who was Chairman, Secretary, and Treasurer of what is popularly known as the Newton-on-Ayr Gas Company. Mr. M'Vicar held too many offices. Doubtless it was an unswerving belief in his integrity which induced the shareholders to place their affairs so freely in his hands. It is always thus. A man to be successful in deceit must be very particular to wear the guise of most thorough uprightness. This man did so. He was trusted beyond measure; and, as the Judge remarked, when passing sentence of seven years penal servitude upon him, he abused that trust by embezzling. The Gas Company are the losers by the crime to the amount of £9000 or more—this being the sum which was admitted. It will be uphill work for the Company to make good the loss. They have the sympathy of other companies. This particular Company have learned a lesson which they are not likely to forget. It would be well if others would read the lesson aright, and, in the interests of their officials as well as of themselves, put a termination to the holding of all duplicate offices. It is a safe general rule that in the administration of the finances of an undertaking, no single person should do the work of two.

On Thursday, the Water and Gas Committee of the Inverness Town Council had before them the report of the Gas Manager—Mr. A. Thomson—with regard to the coal contracts for the year. The Convener—Mr. G. Young—stated that the quantity required was 9500 tons, the cost of which if carried by rail would be £8658, and if seaborne, £8624. He moved that they recommend the Council to procure 5000 tons by rail, and the remaining 4500 tons by sea. The cost, purchasing in this way, would be £8416. This is £550 less than the amount of the contract last year, for the same quantity of coal, taken in the same way. The motion was agreed to.

The Hamilton Town Council recently, in a spirit of economy, resolved that after May 1 the street lighting would be suspended for several months. The decree was carried into effect at the beginning of the month; but the result was not a happy one. There was no moon, nor, indeed, any sun. The discomfort was so universally felt that on Tuesday evening the Magistrates met and resolved that the lighting season should be continued for another fortnight. The street-lamps were accordingly lighted on Wednesday evening.

The Biggar Town Council had before them this week a petition and plans by the Biggar Gaslight Company, relative to proposed additions and alterations at the gas-works; and these were passed—authority being granted in terms of the Burgh Police (Scotland) Act.

The Aberdeen Town Council on Wednesday had before them a somewhat novel question, which arose in connection with their Electricity Supply Department. A Mr. W. Jackson obtained a supply of electricity for power purposes; and when he obtained the current, he applied it in the driving of a dynamo for the further generation of current, which he employed for the lighting of his premises. As for power current is much cheaper than for lighting, the Electrical Engineer intimated to Mr. Jackson that his supply would be charged as for lighting, and not for power. Mr. Jackson maintained that he was entitled to be supplied with current at the rate for power; and the matter was laid before the Electricity Committee, who homologated the action of their Engineer. Then the matter came before the Town Council. It was argued, on behalf of the Committee, that Mr. Jackson was taking advantage of the power rate to generate electricity for lighting, in competition with the Corporation. On the other side, it was argued that the current used by Mr. Jackson for lighting was not that which was supplied to him by the Corporation, and that the Corporation had nothing whatever to do with whether Mr. Jackson used the current to drive a piano or a dynamo. The Convener of the Committee intimated, at the end of a discussion, that Mr. Jackson had ceased to take current from the Corporation; and the action of the Committee in charging at the lighting rate current supplied for power purposes was affirmed.

The Leslie (Fifeshire) Gaslight Company are about to erect a gasholder. The offer of Messrs. Henry Balfour and Co., Limited, of Leven, for this has been accepted.

Negotiations, it is reported, are far advanced for the amalgamation of the firms in Scotland who are engaged in the production of tubes. The present intention is that all the firms who produce iron and steel

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tubes should be formed into one liability company, with the exception of Messrs. Stewarts and Lloyds, Limited, who would, however, hold ordinary shares in the Company. A combination already exists between the British, French, German, Belgian, Italian, and United States manufacturers, which is based upon a definition of the spheres of interest of each country, the fixing of the minimum prices at the ports of shipment, restriction of the output, the prevention of dumping, and the excessive accumulation of stocks. This combination, it is said, has already led to an advance in prices to the amount of not less than 35s. per ton.

In an article which was published in the "Glasgow Herald" on Wednesday, apparently as a feeler, the writer throws out the suggestion, but seems to hesitate to recommend, that a general manager might be appointed over the various departments of the Corporation. This appointment he postulates may be necessary on account of the unprecedented development of municipal trading concerns now carried on by the Corporation. Presuming that it would be a necessary and reasonable preliminary to the consideration of any such proposal that the existing managers of departments should have their interests conserved, he goes on to amplify almost the only point which has ever been put forward to illustrate the economies that might be expected to be derived from a centralization of authority—that of the opening up of the streets. The streets, he remarks, are vested in the Corporation; and for their condition the Statute Labour Department, through the Master of Works, is responsible. He concludes that one would naturally think that if any department of the Corporation required to open up streets, the work would be done by the officers of the Statute Labour Department, and be charged against the department interested. This, however, is not the case. The Gas, Water, Electricity, and Tramways Departments have each a separate staff for this kind of work, and each opens up and repairs the public streets whenever required for the particular department. He goes on to say: "The Tramways, Gas, and Water Departments, which are not assessing departments, might, when under the necessity of interfering with the streets in the city, deal generously with the Statute Labour Department, which is an assessing department, and in this way substantial relief might be given to the ratepayers. In the case particularly of the tramways something of this kind should be done, because inside the city the undertaking only pays municipal assessments on one-fourth of its annual value, whereas in the county it pays county assessment on the full value, and at the same time the tramways are bound to give the same cheap fares in the county as in the city. Again, take the gas undertaking. The Corporation, except in one special area, are bound to give gas beyond the city boundaries at the same cheap rate as is charged in the city. Therefore the ratepayers in the city ought to get a liberal grant from the gas profits in reduction of rates, in return for the great financial responsibility undertaken by them on behalf of residents beyond the city. The Gas Acts contain some provisions which would enable this to be done. These are instances where a general manager would be useful. He would be as interested in the Statute Labour Department as the tramways or gas. But under the present system the Tramways Manager or the Gas Manager finds it difficult to see other departments. To a general manager the first consideration would be the city, and the ratepayers thereof; whereas to a departmental manager a person in or beyond the city is the same." This long quotation seems to be a special plea for the Master of Works being appointed general manager, simply for the sake of his being able to control the small—though, to the public, very irritating—department of municipal work involved in the opening up of the streets. Would not the purpose be served equally well if, instead of making the managers of departments subservient to the Master of Works, he should be instructed to hold himself subservient to them to the extent of his giving notice to them—say two years beforehand—of all the streets he proposed to deal with, so that they might be able to include in their estimates provision for overhauling their services in those thoroughfares when he had them in hand? Even such an arrangement as this would not, any more than the appointment of a general manager, overcome the inconveniences arising out of such situations as a sudden increase, in any district, of a demand for the supply of a particular department—a state of matters which cannot be foreseen by anybody, or which, to the extent to which it can be foreseen, can be best done by the responsible heads of departments. If no more forcible arguments can be put forward for the appointment of a general manager than are contained in this article, the Corporation will be well advised if, instead of adopting such a policy, they first try the reverse one of giving more power to the existing heads of trading departments, and make the "sleepy hollows" of assessing departments wake up and come to the assistance of those who are striving to serve the community according to up-to-date notions.

Gas and Water Profits at Filey.—At the meeting of the Filey Urban District Council last Tuesday, it was stated that the past year's working of the gas undertaking had resulted in a profit of £190, half of which it was decided to devote to the relief of the rates, giving the consumers of gas the benefit of the other half in a reduction of 2d. per 1000 cubic feet. The water undertaking also, for the first time in its history, showed a balance of £25 over expenditure, which amount was to be transferred to the district fund.

The Affairs of Mr. H. K. Kindler.—A special meeting of the creditors of Mr. Herbert Kell Kindler, late Assistant-Manager at the Maidstone Gas-Works, was held a short time ago for the purpose of arriving, if possible, at an amicable arrangement. In the result, Mr. Kindler, acting on the advice of his Solicitor, determined to end the matter by filing his petition; thus avoiding any further expense. This he accordingly did. The "London Gazette" for the 28th ult. announced that a receiving order in bankruptcy had been made against Mr. Kindler, who was described as a gas engineer. The first meeting of creditors was held at Maidstone last Wednesday. The debtor's statement of affairs showed gross liabilities amounting to £20,446 18s. 3d., of which £19,288 8s. was expected to rank for dividend. The assets were estimated by the debtor to produce £680 16s. 5d.; leaving a deficiency of £18,607 11s. 7d.

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Camberwell, S.E.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 9.

Sulphate of Ammonia.

Although home demand has fallen off, export requirements have been sufficient to absorb the moderate supply available, and prices have been fully maintained. The buying has, however, been mainly for immediate delivery, and but little attention has been given to delivery over the month. The closing quotations are £12 7s. 6d. to £12 8s. 9d. per ton f.o.b. Hull, £12 11s. 3d. per ton f.o.b. Liverpool, and £12 12s. 6d. per ton f.o.b. Leith. The forward position has been neglected. Producers have modified the views they held in March; but they are not disposed to force sales, while buyers remain indifferent. £12 5s. and £12 7s. 6d. per ton, according to port of shipment, are the quotations f.o.b.

Nitrate of Soda.

This article is quiet in all positions; and the spot prices are 10s. 1½d. and 10s. 3d. per cwt. for 95 per cent. and refined qualities respectively.

LONDON, *May* 11.

Tar Products.

There is little or no alteration in the markets for tar products. Pitch is quiet. For prompt delivery, business is still possible at 19s. on the east coast; while some quantity has been sold at 20s. Liverpool. For forward delivery, a fair amount of business has been done for September, 1908, to June, 1909, at a price very little in advance of to-day's prompt values. It is evident that some of the makers are realizing very large quantities, which the Continental consumers will carry forward to the end of this season, and are placing some portion at any rate of their next season's make. In South Wales, a large business has been done for delivery to the end of the year at a low figure. Creosote is quiet. Business is stated to have been done in salty oil at 2d. per gallon for prompt delivery; while it is possible to buy without difficulty at 2⅛d. to 2¼d., according to quality. In the Midlands, makers are firm—being well sold. In the North, very low offers are reported to have been taken. Benzol, 90 per cent., is quiet. Business has been done at 7½d. f.o.b. east coast ports. Benzol, 50-90 per cent., is easy. It is possible to buy at 7¼d. in the North, and 7¾d. in London. Solvent naphtha remains unchanged; and there is very little demand for this article. No sales are reported in anthracene.

The average values during the week were: Tar, 11s. 9d. to 15s. 9d. *ex* works. Pitch, London, 20s. to 20s. 6d.; east coast, 19s. to 19s. 3d.; west coast, 19s. to 20s. Benzol, 90 per cent., North 7⅛d., London 8d.; 50-90 per cent., North 7¼d., London 7¾d. Toluol, London 8¼d., North 7⅛d. to 7¾d. Crude naphtha, London 3⅛d. to 3⅜d., North 3d. to 3⅛d.; solvent naphtha, London 9¾d. to 10d., North 8¾d. to 9d.; heavy naphtha, London 10d. to 10½d., North 9d. to 9½d. Creosote, London 2d. to 2¼d., North 2d. to 2⅛d. Heavy oils, 2⅝d. to 2¾d. Carbolic acid, 60 per cent., London and east coast 1s. 6¼d. to 1s. 6¾d., west coast 1s. 5⅞d. to 1s. 6¼d. Naphthalene, £4 10s. to £8 10s.; salts, 30s. to 32s. 6d. Anthracene, "A" quality, 1½d. to 1⅝d. per unit.

Sulphate of Ammonia.

The market for this article remains firm. The principal London Gas Companies still quote £12 12s. 6d. for prompt delivery, and £12 7s. 6d. for July-December. In Hull, business is reported to have been done at £12 8s. 9d.; while in Liverpool, £12 11s. 3d. has been paid. In Leith, some business was done towards the end of last week at £12 12s. 6d.

COAL TRADE REPORTS.

Lancashire Coal Trade.

There is little change to record in the coal trade of the county. The demand for house coal is easier; and engine fuel is slightly less in request. There is, however, no alteration in prices. The shipping trade continues active. Vessels were reported last week to be waiting in the Ship Canal for coal. Favourable reports of coal for shipping are also general from Yorkshire and Lincolnshire ports. The export trade keeps steady. The prospects of a reduction in coal quotations are somewhat remote. As the requirements for house fuel become less, slack will become more scarce and probably dearer. Gas coke has been increased 10d. per ton. The Gas Committee of the Manchester Corporation have invited contracts for the supply of coal and cannel for the ensuing year, and are hoping to get easier terms than last year. On Wednesday, the Salford Corporation sanctioned the Gas Committee's selection of coal and cannel contracts to the extent of about 150,000 tons, to be supplied during the ensuing year. Seven different colliery companies share in the orders. As the prices were not given on the *agenda* at the Council meeting, the question as to the advisability of publishing them was discussed; but the resolution that they should be open to publication was defeated by 18 votes to 16. It is the coal contractors who do not like their prices made known; and the same feeling is shared by the majority of the members of the Council, who are led to believe that the Gas Committee, and consequently the inhabitants, benefit by their concealment.

Northern Coal Trade.

There has been a sharper demand for certain classes of coals in the last few days; and the markets have been active. For some of the best kinds, there has been a scarcity for prompt delivery, which has tended to stiffen the prices in the northern coal trade. For best Northumbrian steam coals, the current quotation is from 13s. 9d. to 14s. 6d. per ton f.o.b., second-class steams are from about 12s. 3d. to 12s. 6d., and steam smalls are steadier at about 7s. to 7s. 6d. The production at the collieries is now very full. It is, however, readily taken up, and some of the producers are well sold for some weeks ahead. In gas coals, the market is steady; for though the local consumption is naturally less at this season of the year, the exports are heavier. The beginning of shipments to the Baltic will add to the activity. Durham gas coals are being quoted at from about 10s. 9d. to 11s. 3d. per ton f.o.b. for usual qualities, and from 12s. to 12s. 3d. per ton for "special Wear" kinds.

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The large contracts for London may now be looked on as substantially settled. The Bournemouth gas coal contracts are believed to be settled, but the prices are not yet known; and tenders for some 40,000 tons for Darlington are expected to be at lower figures than a year ago. Coke is firm; and gas coke is less plentiful. Good gas coke is quoted from 14s. to 14s. 6d. per ton f.o.b.

Scotch Coal Trade.

There is a good demand for all classes of coal, ell in particular. Splint, for export, is also in request. The sorts least sought after are washed stuffs and dross. The prices quoted are: Ell 11s. 3d. to 12s. 6d. per ton f.o.b. Glasgow, splint 11s. to 11s. 3d., and steam 10s. 3d. to 10s. 6d. The shipments for the week amounted to 309,442 tons—an increase of 19,204 tons upon the previous week, and of 12,431 tons upon the corresponding week of last year. For the year to date, the total shipments have been 4,204,022 tons—a decrease of 334,790 tons upon the corresponding period of 1907.

The coalowners are reported to have found the recent decision of Lord Ardwall, reducing the wages of the miners by 6½ per cent.—equal to 3d. per day—to have been so beneficial to trade that they have resolved to ask for a further reduction. What they ask for this time is a reduction of 25 per cent. on the 1888 basis, which is equal to 1s. per day.

Fires in the City Last Year.—According to the annual report of the City Coroner (Dr. F. J. Waldo) nine fires connected with the use of gas occurred during the past year in the City area. They were as follows: Escape of gas, 4; gas-stoves, 2; and one each caused by explosion, decorations coming in contact with gas-light, and seeking an escape of gas with a light. Five fires were due to defective electrical arrangements.

Oldbury Gas Undertaking.—At a recent meeting of the Oldbury District Council, the Gas Committee reported that the quantity of gas sent out during the year ending the 31st of March was 132,542,000 cubic feet, compared with 126,471,000 cubic feet in the preceding year; being an increase of 6,071,000 cubic feet, or at the rate of 4·8 per cent. A vote of thanks was accorded to Mr. J. W. Wilson, M.P., who had retired from the chairmanship of the Committee after twenty years' service.

Gas Profits at Spalding.—At the meeting of the Spalding Urban District Council last Wednesday, Mr. G. Massay, in the course of his annual financial statement, said he estimated the profits from the gas-works during the past year at not less than £2000, after supplying the gas consumers at 2s. 6d. per 1000 cubic feet, and the free lighting of the town, the cost of which could not be put at less than £900. It was now proposed to abolish meter-rents, and so make the consumers a present of a further £200 per annum.

Advantages of Tarring Roads.—The effects of motoring and road-tarring in Hertfordshire were discussed at a meeting of the Herts County Council on Monday last week. The Highways Committee reported on experiments in tarring the main roads last summer; and they stated that tarring was found to preserve them in many ways—one good effect being that the roads were hard, even in winter, through the subsoil being kept dry. From the report of the Surveyor (Mr. U. A. Smith), it appeared that one coating of tar would last as long as a coating of granite on roads much used by motor-cars. Besides reducing the cost of maintenance, tarring the main roads had the effect of remedying the dust nuisance. On this report, the Council decided to tar another 50 miles of roads, at a cost not exceeding £40 a mile.

Rotherham Gas-Works Management.—At the meeting of the Rotherham Town Council last Wednesday, Alderman Gummer, in submitting the annual report of the Gas Committee, referred to the recommendation it contained to increase the salary of the Engineer (Mr. J. S. Naylor) to £550 per annum, to be further advanced at the expiration of twelve months to £600 per annum. He said Mr. Naylor had been a servant of the Corporation for three years, and since his appointment the sales of gas had increased by 51 million cubic feet, and the number of consumers by 800. The most notable improvement had been in the reduction in the leakage of gas. When he became Engineer, the leakage was 12·5 per cent.; and it had been reduced to 8·3 per cent. At the lowest selling price of 1s. 6d. per 1000 cubic feet, this represented £780 per annum. They had in Mr. Naylor a most excellent servant, who looked properly after the interests of the Corporation. During the past three years, the average profits had risen from £1657 to £5795. Since his appointment the works had been kept in good repair, and liberal sums allowed for depreciation and the maintenance of the works. He testified to the loyal manner in which Mr. Naylor and his staff had supported him, as Chairman, and the members of the Committee. The report was approved.

A Glaring Instance of Improper Municipal Trading is how the "Pall Mall Gazette," in their "City Notes" on Saturday week, characterized the condition of affairs divulged in the Chairman's speech at the previous day's meeting of the Cape Town Gas Company—a condition "which, in fact, quite puts to shame the efforts of some of our own municipalities." The Chairman (as will be seen by the report of the meeting appearing last week) explained that the borough of Woodstock invited tenders for the lighting of the public streets; and the neighbouring Cape Town Municipality offered to supply electricity at such a ridiculously low level as to be below actual cost. Our contemporary continues: "Against such competition, there was no possibility of the Company holding its own; and consequently it lost the public lighting of Woodstock. Similarly, many customers have been drawn away by the supply of electricity by the Municipality for power purposes at specially low levels; and in order to retain even a portion of these customers, it was necessary for the Company to reduce the price of its gas—a considerable amount of profit being sacrificed. We do not know whether the Cape Town ratepayers are satisfied that their neighbours and private individuals should enjoy these advantages at their expense; but we can quite imagine the outcry that such a state of things would cause in England. A party pledged to Municipal Reform should have an excellent chance of getting in in Cape Town in the near future."

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Metropolitan Borough Councils and Steam-Rollers.—In compliance with the request of the Gaslight and Coke Company, to which reference has already been made in the "JOURNAL," nearly all the Metropolitan Borough Councils have agreed to give the Company friendly notice when it is intended to use steam-rollers on roads.

Blackburn Gas and Water Supply.—The accounts of the Blackburn Corporation gas undertaking for the year ending March 25 last show a net profit of £9177. It is carried to the reserve fund account, which discloses an overspent balance of £6197. The accounts of the water undertaking show a profit of £1331, which is £737 less than for the previous year.

Public Lighting of Stowmarket.—The Stowmarket Urban District Council have decided to accept the tender of the lessees of the gas-works (Messrs. Thomas Prentice and Co.) to light the streets for £227 14s. per annum during the next five years. Electric light was offered by the Stowmarket Electric Supply Company at a yearly charge of £160; but the Council were to provide the necessary lanterns and wires, and do the erection, which would, it is stated, have cost £632.

Wigan Gas Undertaking.—At the monthly meeting of the Wigan County Borough Council last Wednesday, the Mayor (Mr. S. Wood, J.P.), in moving the adoption of the minutes of the Gas Committee, in the absence of the Chairman (Alderman Holmes), said he had been requested to state that the total revenue of the gas undertaking for the year ending the 31st of March had been £83,498, and the expenditure £56,068, showing a gross balance of £27,430, from which had to be deducted interest and sinking fund charges; leaving a net profit, including £5377, the cost of gas supplied free for public lighting, of £9925.

Fatality at the Fulham Gas-Works.—Mr. John Troutbeck held an inquest at the Westminster Coroner's Court last Thursday concerning the death of James William Targrass, aged 34, a steeplejack, who died in St. George's Hospital from injuries sustained in a fall from the chimney at the works of the Gaslight and Coke Company, Fulham Road. He and another man named William Neagle were occupied in pulling down the chimney, which was 140 feet high. He fell 65 feet from the top of the square base while walking round it to move a rope. A verdict of "Accidental death" was returned; no blame being attached to anybody.

Ipswich Water Supply.—There was a net profit on the Ipswich water undertaking for the past year of £821, against a credit balance the previous year of £1464. The gross profit for the twelve months to March 31 last was £11,464, of which £10,659 had to be paid in redemption of money borrowed and interest, and contributions to the consolidated loans fund. It is proposed to make a contribution from the water-works fund to the general district rate of £1000, which will reduce the balance in the bank from £2527 to £1635. The Town Council have, on the unanimous recommendation of the Water Committee, raised the salary of the Water Engineer and Manager (Mr. C. W. S. Oldham) from £250 to £300 a year.

Public Lighting in Shoreditch.—At the meeting of the Shoreditch Borough Council last Tuesday, the Lighting Committee reported that they had inquired into complaints as to defective gas lighting in the streets of the borough. They found that the recent high winds had been responsible for a large amount of damage to the mantles; but they had satisfied themselves that these were replaced as quickly as possible under the circumstances. With reference to a question raised as to the quality of gas supplied to the public lamps, it was stated that tests are periodically made by the London County Council; and according to the latest report issued, the candle power of the gas in Shoreditch was shown to be above the standard specified. The report was adopted.

Bradford Corporation Gas Undertaking.—The result of the past year's work in the Bradford Corporation Gas Department has proved gratifying. In spite of the fact that the increased price of coal entailed an expenditure under this head alone of £14,892 in excess of the previous twelve months, a profit is shown of £3072, which is only £414 below that for the year 1906-7. The revenue from the sale of gas was higher by £3817; but the principal increase is the larger income from the sale of coke, amounting to £8222. It is stated that this is in great measure due to the policy of the Gas Committee in distributing broken coke in small quantities for household use—a course which has proved more remunerative than the selling of large consignments to iron-works and other extensive concerns.

Safety Light, Limited.—Under this title, a Company has been registered with a capital of £150,000, in £1 shares, to adopt a certain agreement (the parties to which are not named), to acquire and turn to account inventions, processes, patents, licences, concessions, rights, and privileges, and to carry on the business of electrical engineers, producers of electric light or power, gas makers, vendors, and suppliers, water supply engineers, &c. Among the signatories and first Directors is Mr. L. B. de Laitte; the other Directors being Messrs. A. Shanks, D. N. Ritchie, J. A. Tinling, E. Walden-Vincent, and one other to be nominated by the De Laitte Gas-Machine Company, Limited. As soon as the Elwell-Smith Petrol Safety Gas Company, Limited, shall have subscribed for £22,500 of an issue of £40,000 of first mortgage debentures, Messrs. Ritchie, Walden-Vincent, and Tinling are to have the right to nominate one other Director.

New Water-Reservoir for Otley.—On Saturday, the 2nd inst., the members of the Otley Urban District Council drove to Middleton, on the hills above Ilkley, to pay a final visit of inspection before handing over to the Contractors (Messrs. Arnold and Sons, of Doncaster) the cheque for £2000 which they have held as retention-money in connection with the new water-works. They were accompanied by Mr. T. A. Duncan, who was Chairman of the Water Committee during the construction of the works, the Clerk (Mr. E. C. Newstead), and the Water-Works Manager (Mr. J. E. Sharpe). They were met at the works by Mr. John Waugh, of Bradford, the Engineer for the scheme, who was able to impart the welcome information that certain rumours with regard to a supposed leakage in the reservoir were entirely without foundation. Everything, in fact, was found to be in perfect order; and the councillors looked with something like pride on the 85 million gallons of stored water that will serve Otley for nearly a year, if not another drop of rain falls in the meantime.

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The Lewisham Borough Council have made claims, amounting in the aggregate to £745 10s. 4d., against various companies and authorities in respect of the breaking-up of roads and footpaths during the quarter ended March 31. Included in them are £40 15s. 9d. from the South Suburban Gas Company, and £174 9s. 5d. from the South Metropolitan Gas Company.

According to statements made by the Clerk and the Gas Manager to the Coleraine Urban District Council at their last monthly meeting, the financial results for the year ended the 31st of March showed that the new plant at the gas-works was so far satisfactory; there being a diminished wages bill in proportion to the make of gas, a larger yield of coke per ton of coal carbonized, and other economies.

An outbreak of fire was discovered last Friday week in the middle assembling floor at the works of the Foster Arc Lamp Company at Wimbledon. The cause has not been discovered. Early last Thursday morning, an extensive fire broke out at Coatbridge, burning to the ground the East-end Sawmills, occupied by Mr. John Twaddell. The cause of the fire is unknown, as no fire or boiler was about the place—all the machinery being driven by electric motors. The total damage is estimated to be upwards of £10,000.

The Gas Committee of the Manchester Corporation have approved of the estimate of the cost of the public lighting of the city for the year ending March 31, 1909, at £54,833.

The Directors of Messrs. Fletcher, Russell, and Co., Limited, announce a final dividend at the rate of 5 per cent. per annum on the ordinary shares; making 7½ per cent. for the past year.

During the past season, the Wholesale Fittings Company, Limited, made a speciality of their "Ezol" lamp. We learn that the lamp has since been much improved, so that with a normal consumption of gas the illuminating power has been increased; the makers now claiming that with only 3½ cubic feet of gas per hour a light of 110-candle power is produced without any assistance from outside sources. This result has been achieved by the introduction of a chimney, ensuring a perfect and regular draught of air, which, owing to the use of a closed globe, is heated to just the temperature needed to effect the fullest consumption of the mixed gas and air supplied to the bunsen tube. The air and gas regulators have also been carefully readjusted by the light of practical experience. The lamp is supplied in polished brass or antique copper or steel, as desired; and it will take all ordinary inverted globes and mantles. It is of British manufacture.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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"ILLUMINATING TRUTHS."

LEAFLETS FOR DISTRIBUTION.

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."
No. 7.—"The Osram Lamp: Fiction and Fact."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.
Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 346.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
530,000	10	Apl. 10	10	Alliance & Dublin 10 p.c.	18½–19½	..	5 2 7
268,324	10	,,	7	Do. 7 p.c.	13–14	..	5 0 0
310,000	Stk.	Jan. 16	4	Do. 4 p.c. Deb.	100–103	..	3 17 8
200,000	5	Oct. 30	6¼†	Bombay, Ltd.	6¼–6⅝	..	4 16 4
40,000	5	,,	6¼†	Do. New, £4 paid	4½–5	..	5 4 0
50,000	10	Feb. 27	14	Bourne-mouth Gas & Water } 10 p.c.	27–28	..	5 0 0
51,810	10	,,	7	Bourne-mouth Gas & Water } B 7 p.c.	16½–16⅝	..	4 3 7
53,200	10	,,	6	Bourne-mouth Gas & Water } 6 p.c.	14–15	..	4 0 0
380,000	Stk.	,,	12½	Brentford Consolidated	241–246	–1	5 1 8
300,000	,,	,,	9⅜	Do. New	180–185	..	5 2 8
50,000	,,	,,	5	Do. 5 p.c. Pref.	118–123	..	4 1 4
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb.	100–105	..	3 16 2
220,000	Stk.	Mch. 12	11¼	Brighton & Hove Orig.	202–207	+4½	5 8 8
246,320	,,	,,	8¾	Do. A, Ord. Stk.	152–157	..	5 5 1
460,000	20	Mch. 27	10	British	41½–42½	..	4 14 1
104,000	Stk.	Feb. 13	6	Bromley, Ord. 5 p.c.	116–119	..	5 0 10
165,700	,,	,,	4½	Do. do. 3½ p.c.	86–89	..	5 1 2
500,000	10	Oct. 11	7	Buenos Ayres (New) Ltd.	11½–12	..	5 16 8
250,000	Stk.	Dec. 13	4	Do. 4 p.c. Deb.	93–95	..	4 4 3
150,000	20	Mch. 12	7½	Cagliari, Ltd.	25–26	..	5 11 6
100,000	10	—	—	Cape Town & Dis., Ltd.	4–6	..	—
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	7–9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	46–48*	..	6 5 0
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	92–94	..	4 15 9
157,150	Stk.	Feb. 27	5	Chester 5 p.c. Ord.	105½–107½	..	4 13 0
1,493,280	Stk.	Mch. 12	5⅛	Commercial 4 p.c Stk.	104–109	..	4 15 5
560,000	,,	,,	5	Do. 3½ p.c. do.	100–105	..	4 15 3
475,000	,,	Dec. 13	3	Do. 3 p.c. Deb. Stk.	82–84	..	3 11 5
800,000	Stk.	,,	0⅛	Continental Union, Ltd.	115–120	..	5 8 4
200,000	,,	,,	7	Do. 7 p.c. Pref.	140–145	..	4 16 7
469,170	Stk.	—	5½	Derby Con. Stk.	132–133	..	4 9 5
55,000	,,	—	4	Do. Deb. Stk.	103–105	..	3 16 2
148,995	,,	Mch. 31	5	East Hull 5 p.c. Ord.	100–103	..	4 17 1
486,090	10	Jan. 30	12	European, Ltd.	23–24	..	5 0 0
354,060	10	,,	12	Do. £7 10s. paid	16½–17½	..	5 2 10
15,182,590	Stk.	Feb. 13	4⅛	Gas-light and Coke } 4 p.c. Ord.	94–96	..	4 11 8
2,600,000	,,	,,	3⅜	Gas-light and Coke } 3½ p.c. max.	87–90	..	3 17 9
3,799,735	,,	,,	4	Gas-light and Coke } 4 p.c. Con. Pref.	106–109	..	3 13 5
4,193,975	,,	Dec. 13	3	Gas-light and Coke } 3 p.c. Con. Deb.	83–85	..	3 10 7
258,740	Stk.	Mch. 12	5	Hastings & St. L. 3½ p.c.	93–95	..	5 2 0
82,500	,,	,,	6⅛	Do. do. 5 p.c.	112–115	..	5 13 1
70,000	10	Apl. 29	11	Hongkong & China, Ltd.	18½–19½*	..	5 12 10
4,940,000	Stk.	Nov. 14	8	Imperial Continental	179–181	..	4 8 5
473,600	Stk.	Feb. 13	3½	Do. 3½ p.c. Deb. Red.	93–95	..	3 13 8
195,242	Stk.	Mch. 12	6	Lea Bridge Ord. 5 p.c.	113–118	..	5 1 8
561,000	Stk.	Feb. 27	10	Liverpool United A	227–229	..	4 7 4
718,100	,,	,,	7	Do. B	162–164	..	4 5 4
306,083	,,	Dec. 30	4	Do. Deb. Stk.	106–108	..	3 14 1
152,736	Stk.	Feb. 13	7⅜	Maidstone 5 p.c.	136–141	..	5 8 2
75,000	5	Nov. 28	5	Malta & Medn., Ltd.	4½–4⅝	..	5 5 3
560,000	100	Apl. 1	5	Met. of } 5 p.c. Deb.	100–102	..	4 18 0
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	99–101	..	4 9 1
541,920	20	Nov. 14	3½	Monte Video, Ltd.	10¾–11½	..	6 1 9
1,775,892	Stk.	Feb. 27	4⅜	Newc'tle & G'tesh'd Con.	106½–107½	..	4 6 1
418,462	Stk.	Dec. 31	3½	Do. 3½ p.c. Deb.	89–91	..	3 16 11
15,000	10	Feb. 27	10	North Middlesex 10 p.c.	20–21	..	4 15 3
55,940	10	,,	7	Do. 7 p.c.	13½–14½	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	140–143*	..	5 11 11
60,000	5	Mch. 27	7	Ottoman, Ltd.	6–6⅜	..	5 7 8
398,490	5	Apl. 29	7	Primitiva Ord.	6⅛–6⅜*	..	5 3 8
796,980	5	Jan. 30	5	Do. 5 p.c. Pref.	4⅜–5⅛	..	4 15 3
488,900	100	Dec. 2	4	Do. 4 p.c. Deb.	93–95	..	4 4 3
1,000,000	10	Apl. 29	8	River Plate Ord.	13–13⅛*	–¼	5 18 6
312,650	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	93–95	..	4 4 3
250,000	10	Apl. 10	8	San Paulo, Ltd.	13⅛–14	..	5 14 4
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	50–52	..	4 16 2
135,000	Stk.	Mch. 12	10	Sheffield A	245–247	+1	4 1 0
209,984	,,	,,	10	Do. B	245–247	+1	4 1 0
523,500	,,	,,	10	Do. C	245–247	+1	4 1 0
70,000	10	Nov. 14	10	South African	14½–15½	..	6 9 0
6,429,895	Stk.	Feb. 13	5⅜	South Met., 4 p.c. Ord.	118–120	–2	4 8 10
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.	83–85	..	3 10 7
209,820	Stk	Mch. 12	8	South Shields Con. Stk.	154–156	..	5 2 7
605,000	Stk.	Feb. 27	5⅜	S'th Suburb'n Ord. 5 p.c.	116–119	..	4 9 7
60,000	,,	,,	5	Do. 5 p.c. Pref.	118–121	..	4 2 8
117,058	,,	Jan. 16	5	Do. 5 p.c. Deb. Stk.	120–125	..	4 0 0
502,310	Stk.	Nov. 14	5	Southampton Ord.	107–112	..	4 9 3
120,000	Stk.	Feb. 27	6⅜	Tottenham and } A 5 p.c.	120–125	..	5 8 0
398,940	,,	,,	5⅛	Tottenham and } B 3½ p.c.	102–105	..	5 0 0
149,470	,,	Dec. 13	4	Edmonton } 4 p.c. Deb.	99–102	..	3 18 5
182,380	10	Dec. 30	8	Tuscan, Ltd.	10½–10⅝	..	7 8 10
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	99–101	..	4 19 0
193,742	Stk.	Feb. 27	5	Tynemouth 5 p.c. max.	106–107	..	4 13 6
255,636	Stk.	Feb. 13	6⅜	Wandsworth and Putney } B 3½ p.c.	128–133	..	4 17 9
80,075	,,	Dec. 30	3	Wandsworth and Putney } 3 p.c. Deb. Stk	73–78	..	3 16 11
845,872	,,	Feb. 27	5⅛	West Ham 5 p.c. Ord.	99–102	..	5 0 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	118–120	..	4 3 4
228,300	,,	Dec. 30	4	Do. 4 p.c. Deb. Stk.	102–107	..	3 14 9

† Next dividend will be at this rate. Prices marked * are "Ex div."

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

CHIEF METER INSPECTOR, &c. Cardiff Gaslight Company. Applications by May 29.
SLOT COLLECTOR. Winchester Water and Gas Company.
TEACHER OF GAS-FITTING. Battersea Polytechnic.

Capitalists Wanted (Erecting and Buying Gas-Works). No. 4940.

Plant (Second-Hand) Wanted.

GASHOLDER. Lasswade Gas Company.
CONDENSER. Shotts Gas-Works.

Stocks and Shares.

BARKING GAS COMPANY. May 27.
EAST HULL GAS COMPANY. May 14.
HARROW AND STANMORE GAS COMPANY. May 21.
LOWESTOFT WATER AND GAS COMPANY. May 27.
MAIDENHEAD GAS COMPANY. May 27.
PINNER GAS COMPANY. May 12.
SOUTHEND WATER COMPANY. June 2.
TENDRING HUNDRED WATER-WORKS COMPANY. May 27.

TENDERS FOR

Benzol, &c.

DARWEN GAS DEPARTMENT. Tenders by May 23.
WALSALL CORPORATION. Tenders by May 23.

Building.

CROYDON MENTAL HOSPITAL. Tenders by May 20.

Coal and Cannel.

BARROW-IN-FURNESS GAS DEPARTMENT. Tenders by May 20.
BURTON-ON-TRENT CORPORATION. Tenders by May 20.
CIRENCESTER GAS COMPANY. Tenders by June 4.
CLITHEROE GAS DEPARTMENT. Tenders by May 21.
DROGHEDA GAS DEPARTMENT. Tenders by May 20.
GLOUCESTER GASLIGHT COMPANY. Tenders by May 26.
HAYWARDS HEATH GAS COMPANY. Tenders by May 21.
LLANDUDNO URBAN DISTRICT COUNCIL. Tenders by May 30.
MANCHESTER GAS DEPARTMENT. Tenders by May 19.

Coal and Cannel—*continued.*

MANSFIELD GAS DEPARTMENT. Tenders by May 26.
SAFFRON WALDEN GAS AND WATER DEPARTMENT. Tenders by May 25.
SOUTH STAFFORDSHIRE WATER COMPANY. Tenders by May 18.
TIVERTON LIGHTING COMMITTEE. Tenders by May 30.
TYLDESLEY URBAN DISTRICT COUNCIL. Tenders by May 29.
UXBRIDGE GAS COMPANY. Tenders by May 20.

Coke.

CROYDON GAS COMPANY. Tenders by June 9.

Condensers, &c.

AUDLEY DISTRICT COUNCIL. Tenders by June 1.

Gasholders and Tanks.

AXMINSTER GAS COMPANY. Tenders by May 27.
RATHKEALE TOWN COMMISSIONERS. Tenders by May 22.

General Stores (Lead, Lead Tubing, &c.).

TYLDESLEY URBAN DISTRICT COUNCIL. Tenders by May 29.

Heating.

CROYDON MENTAL HOSPITAL. Tenders by May 20.

Lighting.

CROYDON MENTAL HOSPITAL. Tenders by May 20.

Lime.

BURTON-ON-TRENT CORPORATION. Tenders by May 20.
TYLDESLEY URBAN DISTRICT COUNCIL. Tenders by May 29.
WALSALL CORPORATION. Tenders by May 23.

Meters.

DARWEN GAS DEPARTMENT. Tenders by May 23.
TYLDESLEY URBAN DISTRICT COUNCIL. Tenders by May 29.

Naphthalene Trouble.

APPARATUS WANTED TO OVERCOME. No. 4936.

Oil for Gas Making.

BARROW-IN-FURNESS GAS DEPARTMENT. Tenders by May 20.

Oxide (New and Spent).

DARWEN GAS DEPARTMENT. Tenders by May 23.

Pipes (Wrought and Cast).

DARWEN GAS DEPARTMENT. Tenders by May 23.
TYLDESLEY URBAN DISTRICT COUNCIL. Tenders by May 29.

Purifiers.

RATHKEALE TOWN COMMISSIONERS. Tenders by May 22.

Retort Iron-Work (Hydraulic Mains, Ascension, Arch, and Dip Pipes, &c.).

WALSALL GAS DEPARTMENT. Tenders by May 30.

Retort-Bench (Pulling Down and Rebuilding).

RATHKEALE TOWN COMMISSIONERS. Tenders by May 22.

Sulphuric Acid.

CROYDON GAS COMPANY. Tenders by June 9.

Tar and Liquor.

ACCRINGTON GAS AND WATER BOARD. Tenders by June 8.
BATH GASLIGHT COMPANY. Tenders by June 2.
BURTON-ON-TRENT CORPORATION. Tenders by May 20.
BUXTON GAS DEPARTMENT. Tenders by May 25.
CROYDON GAS COMPANY. Tenders by June 9.
DARWEN GAS DEPARTMENT. Tenders by May 23.
MANSFIELD GAS DEPARTMENT. Tenders by May 26.
SUTTON, REIGATE, AND NEWHAVEN GAS COMPANIES. Tenders by May 28.
TYLDESLEY URBAN DISTRICT COUNCIL. Tenders by May 29.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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Correspondence invited.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
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"NUGEPE" GAS PLANT CEMENT.
JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers.
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SIMULTANEOUS Discharging-Charger.
The one Machine which Discharges and Charges at One Stroke.
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REPAIRS RECEIVE PROMPT ATTENTION.
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SPENT OXIDE PURCHASED IN ANY DISTRICT.

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NYMEGEN, HOLLAND.
General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON,
General Manager (for Scotland)—
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TO Gas Managers, &c., Wanted, Old Condemned GAS-METERS, from 1-light to 1000-light, for destruction to re-claim Metals. Write for Prices, Stating Quantities and Sizes, and if Wets or Drys. Scrap Metals, Drosses, Metal Shop Sweepings, &c., also bought
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J. W. & C. J. PHILLIPS, 23, COLLEGE HILL, LONDON, E.C., and 7, PARK SQUARE, LEEDS.

OLD Gas-Works and Plant Dismantled by Competent Staff, and Best Prices Given for Old Materials.
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GAZINE—A radical Solvent and Preventative of Naphthalene deposits, and the Automatic cleaning of Mains and Services.
It is also used for the Enrichment of Gas, and has an illuminating value double that of 90 per cent. Benzol.
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SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.
BALE & CHURCH,
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SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
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LUX'S GAS PURIFYING MASS.
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FRIEDRICH LUX, LUDWIGSHAFEN-AM-RHEIN.

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BROTHERTON AND CO., LTD., Ammonia Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

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CARBURINE FOR GAS ENRICHING.
ALSO
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BROTHERTON AND CO., LTD., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, WAKEFIELD, and SUNDERLAND.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
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